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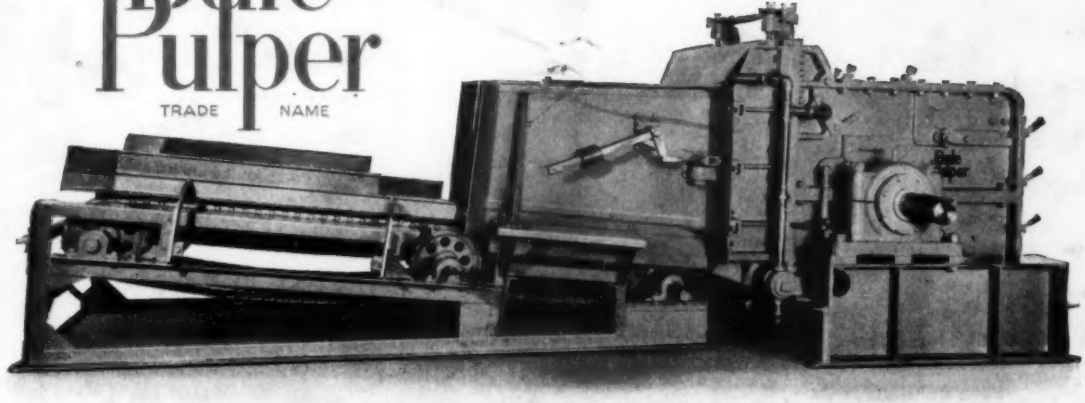
THE PAPER INDUSTRY

A MONTHLY EDUCATIONAL JOURNAL FEBRUARY, 1934

STURTEVANT

Bale Pulper
TRADE NAME



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Why use Waste Paper Breaker Beaters for dry pulp?

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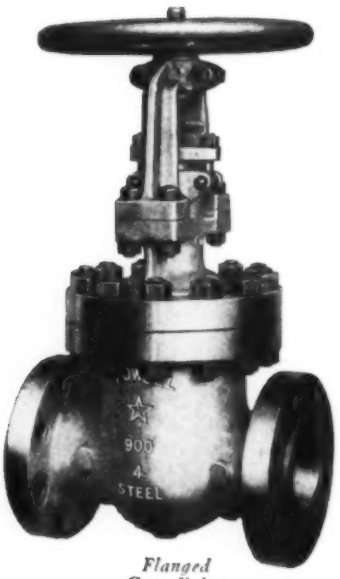
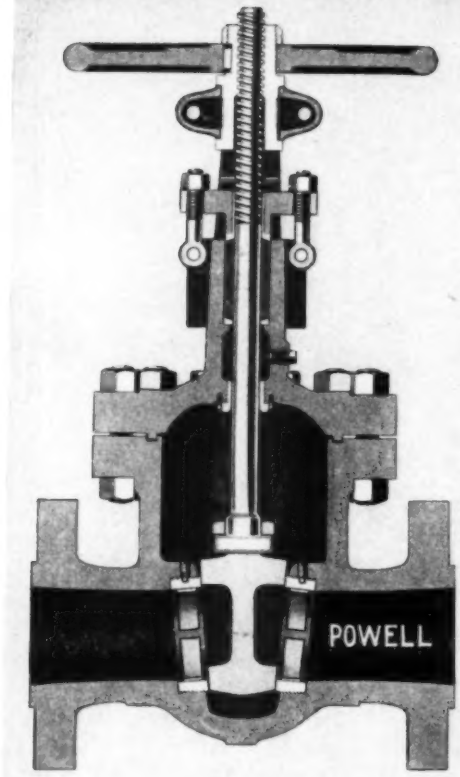
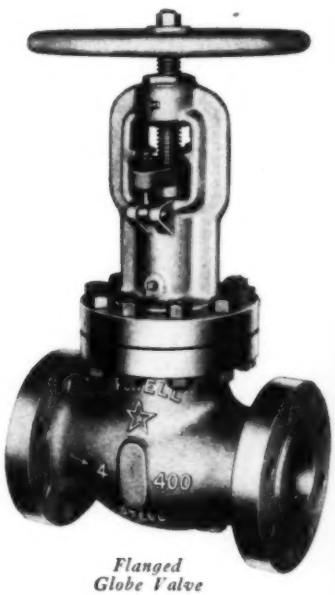
All parts are produced to gauge, are interchangeable, and of equal wearing quality. Modern operating methods and machining facilities insure precision.



Flanged Gate Valve



Flanged Gate Valve Sectional View



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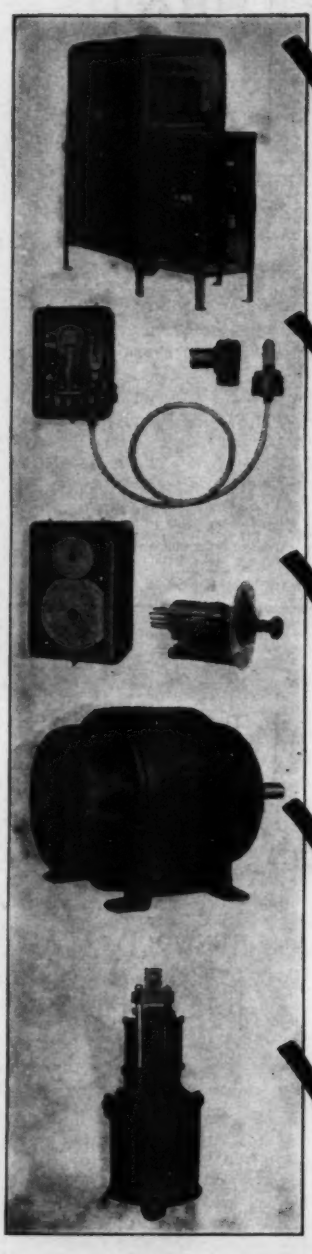
POWELL VALVES

Check

these G-E money-saving equipments



CAPACITORS—If you have a power-factor penalty clause in your power contract, or if operating conditions result in excessive voltage drop on the motor feeders, check the power-factor. If it's low, you can improve it simply and easily by installing a G-E Capacitor. One manufacturer installed a 480-kv-a. capacitor at a cost of $6,318, and the savings on power costs alone paid for it in less than one year.

PHOTOELECTRIC RELAYS—Electric eyes—will solve dozens of your perplexing problems. For example, they may be used to detect breaks of the paper on paper machines; to count boxes, bags, or sheets; to sort objects according to size, color, or shape; to compare or analyze color; or to control the registry of cutting, printing, or wrapping machines.

SELSYN DEVICES—Small, compact, easily installed devices which will tell you at a glance the level in tanks, reservoirs, or sumps situated at remote points. The modern electric paper-machine drive has Selsyn control throughout, while the mechanical drives may be equipped with Selsyns to make "draw" changes from the front side of the machine.

SPLASH-PROOF MOTORS—Designed especially for tough spots—places where open motors cannot be used because of splashing or dripping liquids. The frame and end-shield openings are protected by covers, and a splash-proof conduit box protects the power connections so that liquids cannot splash or drip directly into the windings. Cartridge-type ball-bearing housings make it unnecessary to expose the bearings even when disassembling the motor, and assure long bearing life and low maintenance.

THRUSTORS—Self-contained motor-driven devices that exert a smooth, powerful, straight-line, cushioned thrust. Thrustors are applicable wherever you now use hand- or foot-operated pedals, levers, hydraulic cylinders, or solenoids. They are used to operate paper cutters, and valves controlling white or black liquors, water, steam, oil, or stock. They are available in a large number of sizes. The largest will deliver a thrust of 6400 lb. through a stroke of 64 inches.

If you would like additional information on any of these G-E money-saving equipments, address the nearest G-E office, or General Electric Company, Schenectady, N. Y.

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GENERAL ELECTRIC

THE PAPER INDUSTRY

FEBRUARY, 1934
Vol. XV—No. 11

A MONTHLY EDUCATIONAL JOURNAL
Devoted to the Interests of the Pulp and Paper Industry

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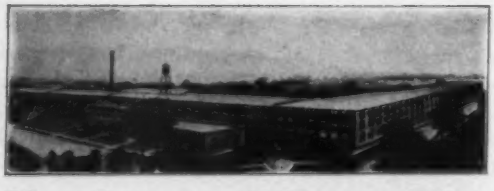

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TAYLOR offers an Automatic Digestor Control System that eliminates Costly Hand Control Variations... Reduces Conversion Costs... Insures Maximum Production of No. 1 Stock. A Sure Way To Further Savings In 1934.

The entire paper making industry is familiar with the advantages of the Taylor System of Temperature Control for Pulp Grinders—equally important economies are in store for you through Taylor Control of Sulphite Digestors.

This simple practical system controls and coordinates the two most important variables in the cooking cycle, temperature and pressure. It enables your plant to schedule cooking operations within a few minutes—insures the production of uniformly highest quality stock.

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The Taylor Digestor Control System is entirely automatic over 90% of the cooking cycle. Variations in gas pressure are automatically compensated for in the steam flow control. Maximum gas is diverted to the reclaiming system before the digestor is blown through the relief valve control.

This Taylor System is easily adapted to any standard vertical-type digestor. Write to us for further information, Taylor Instrument Companies, Rochester, N. Y. or Toronto, Canada.

COMPARE!

Compare the ragged uneven line in the lower right hand chart that results from hand control with the smooth even cycles charted by TAYLOR CONTROL on the two other charts. *Hand control is costly!*

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Lacquer-coated papers possess a number of advantages which no other finishing material can give them. They resist destructive influences to a far greater degree than do papers coated with other materials. Lacquer-coated papers clean more easily, and their life is much longer. ● Lacquer dries hard, producing a tough, resistant coating; yet it is not brittle. Lacquer-coated papers can be bent over sharp corners without cracking or crumbling of the coating, and without losing their high gloss. And packages covered with lacquer-coated papers are washable, without danger to paper, package, or contents. ● In the processing of coated papers for special purposes lacquer proves notably economical. It is not difficult to apply, and offers no difficulty in drying.

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Barium Sulphate (Blanc Fixe)	Salt Cake
Bleach	Silicate of Soda
	Soda Ash
	Sulphuric Acid

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WRITE FOR SAMPLES

THE APPLETON WIRE WORKS, Inc.

APPLETON, WISCONSIN, U. S. A.

*U. S. Patent No. 1893605. Others Pending

BRINGS ADDED LIFE TO APPLETON PHOSALOY FOURDRINIER WIRES

Be a Contributor!

IF there be any doubting Thomases in this country today—any persons who still are doubtful that the depression is behind us and that we are on the sure road back to revaluation of property and business prosperity, it is because those persons do not read the daily records of industrial and trade expansion, or if they do read the reports, they fail to gather the full import of the most momentous trade recovery in the history of commerce.

The year 1934 will witness a tremendous expansion of business volume in every division of industry.

The reports for the first month of the year prove it.

The paper industry will be a particularly favored division, for the consumption of paper depends upon the volume of business transacted. If the volume of business expands, the tonnage of paper consumed expands; if it contracts, the tonnage of paper consumed decreases.

1934 is a tonnage expansion year.

Let's look at the record:

The best index of what is coming is the volume of shares traded in on the New York Stock Exchange. The total sales from January 1 to 31, 1934 were 54,988,939 shares; total sales from January 1 to 31, 1933 were 19,787,882, showing an increase of 35,201,057 shares.

Here is a sheer upturn in volume of 277 per cent of the utmost significance.

Significant, because those financial men, brokers and bankers down in Wall Street, are probably the keenest appraisers of values and market trends in America. The public has only come into the market in a limited way as yet, but the Wall Street operators have been buying stocks and low value bonds in constantly increased volumes. The fact of the matter is that the big upturn in volume buying did not start until Monday, January 15. That was the date they became satisfied that the previous "uncertanties" which existed in their minds as to the effectiveness and definiteness of the administration's monetary policies had been removed.

All subsequent legislation, the passing of the monetary bill by Congress and the Senate by the most impressive majorities and in record-breaking time, has only gone to show how wise these appraisers of stock and bond values are.

Now, what is happening in the stock and bond markets is but the forerunner of what is to happen presently in the industrial, agricultural and real estate markets. Revaluation of all these equities is the order of the day.

The rebuilding of values of every form of wealth is now in process.

The payments of debts and the renewal of profitable operations in every division of human activity are ticketed for the return trip.

It is as impossible to escape the engulfing rising tide of business volume, revaluation of equities, and profitable operations, as it is for a man to get out of his hide.

Let's look at the record again!

Detroit automobile makers have 325,000 men employed and are facing an imminent shortage of skilled mechanical labor.

The steel business ended December 31 operation with a 34 per cent of capacity for the year and 60,000 men on the payroll. The authorities forecast an average operation for that industry of 70 per cent for 1934 which means 125,000 men on the payrolls. C. W. A. must release men to work in the industries,

otherwise, we are faced with a certain drastic shortage of labor this current year.

Space does not permit us to chronicle the host of contributing facts beyond these herein quoted, all going to buttress the indubitable proof that the days of our emancipation from the shackles of depression are over and behind us.

To every remaining doubting Thomas (if there be any), we say: Unshackle yourself, cast off your mental hobbles, liberate your faculties and help bring in the prosperity that you desire, that you must have and that is prepared for you to achieve.

To the vision, courage and ability of one lone man in this country, belongs the credit for turning us right-about-face from the abyss of national bankruptcy to the upward road of reconstruction. The least we can do is to give that indomitable leader our support and confidence.

Be a contributor!

Selling More Paper

NO PROBLEM before the pulp and paper industry of today is more important than that of marketing. Although the uses of paper are quite varied it is not difficult to appreciate the enormous task of disposing of the millions of tons that are produced annually within the United States.

For more than a century, the paper requirements of the country, except for periods of economic storm, have been constantly increasing. In 1810, for example, the per capita consumption of paper in the United States was placed at one pound. The total consumption for the entire year amounted to only 3,000 tons. Within a decade, the total consumption quadrupled and the per capita consumption doubled. The high point in both total and per capita consumption was reached in 1929 when over 13,000,000 tons or 220 pounds per capita were consumed during that year alone.

Naturally, our modern industry has been developed to meet such a demand, but consumption went into reverse in 1930 and it has continued ever since in that direction. The per capita consumption was 199 pounds in 1930, 181 pounds in 1931 and even less in 1932. Such a decrease in requirements forced the paper mills of the country as a whole to operate at approximately 73 per cent of capacity in 1930, 67 per cent in 1931 and 56 per cent in 1932.

Production operations in every mill were imperiled by this turn in affairs. A few of them, not strong enough to weather the gale, were shipwrecked on the economic shoals of business. The majority of the mills, however, through the guidance of skillful helmsmen or through some stroke of good fortune, have continued to avoid the shoals and are now looking forward to smoother sailing.

Increased business for the individual mill will aid in bringing this condition about, and it is up to every plant to study its markets and the uses to which its products are put as never before.

One very well-known paper mill of Michigan has developed a rather unique and very interesting plan to promote the sale of its products. The plan is based upon the premise that a better knowledge of customers' problems will result in an improved handling of business with them, and may open up new and increased uses for their products. In action, it consists of bringing together once a week all sales department heads and their assistants and of presenting to them an oral summary of the editorial content and advertisements of some forty or fifty trade publications covering the paper trade and the industries that consume their products. This oral summary, requiring cover to cover study of some ten to fifteen journals a week, is presented in a rapid and terse style somewhat similar to that of news reporters on the radio. The men take such notes as they choose of items that are of particular interest to them for reference and further study. At the same time, interruptions in the presentation of the summary and short discussions are permitted.

In addition, once a month the head of the research department at the mill presents a similar summary in layman's language of the latest developments in science.

Much of the information obtained at these meetings is immediately passed along to salesmen in their respective territories as an added indication that the home office is doing its utmost to keep them informed of all worthwhile developments.

This plan, instead of permitting the men to ease off on their reading, is apparently resulting in a closer and more intelligent perusal of the various journals than ever before. What is more—results prove that the plan works.

Perhaps this plan or something similar may be helpful to your mill. Consider it.

◆ DO NOT FORGET February 19 to 23, important dates to all associated with the pulp and paper industry. This is the week of the 57th annual convention of the American Paper and Pulp Association with its subordinate groups and the 19th annual convention of T.A.P.P.I. The meetings will be held at the Waldorf-Astoria Hotel, New York City. Arrange to attend and join with others in making this a most outstanding Convention Week.

FACTS NOT CLAIMS PROVE DEGRACO PAINT QUALITY

Cold, hard facts... not "sales talk"... form the correct basis for judging Degraco quality. Learn these facts, then decide for yourself.

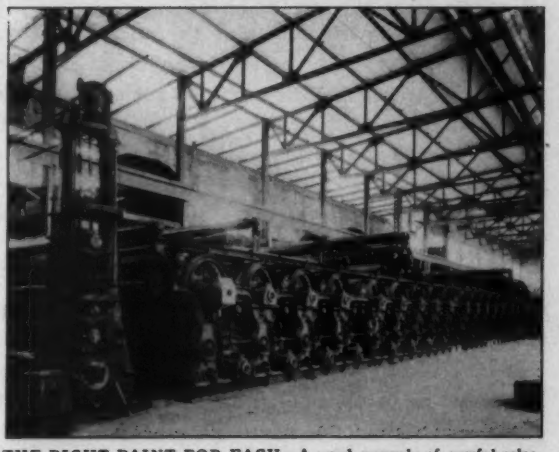
Find out about the scientific Degraco Standardization Plan that is based on strict suitability of the product to fit specific conditions... worked out by a staff of engineers who are experts in the chemical laboratory and in the greater laboratory of world-wide use... over a period of more than 50 years.

Learn about the immense projects served by Degraco... of the amazing records of durability. Degraco paint engineers thoroughly understand the "Fourth Dimension" of paint service—TIME!

Great advances... important developments... have been made in paint manufacture by Degraco. Many of them are absolutely exclusive. One is the secret Synthorizing process, used only by Degraco , . . giving paint astounding resistance to attack by acids, fumes, moisture, weather exposure, and lime or alkali action.

Another exclusive feature is Degraco's natural Amorphous Graphite Pigment. There is only one source of supply in the whole world... and that is exclusively controlled by the Detroit Graphite Company, and its output is used exclusively in Degraco products.

These are only a few of the important facts about Degraco quality. If you want additional facts mail the coupon below... or write us a letter giving facts about your paint problem.



THE RIGHT PAINT FOR EACH—A good example of careful selection . . . the proper Degraco paint for each requirement. Sta-White, light-reflecting paint for the ceiling . . . No. 314 Maroon Machinery enamel for mechanical equipment . . . No. 827 Gray Finish on steel and Brown for steel sash. Degraco engineers know just where each belongs.

BRIGHT AND CHEERFUL—Good lighting brings benefits more important than just appearance. The Marathon Paper Company knows this, and has chosen Degraco Sta-White finish because of its ability to reflect a high percentage of light rays and thus improve working conditions in many ways. Sta-White is the choice of hundreds of leading industrial plants because it brings greater accuracy in workmanship, prevents spoilage, reduces eye strain, prevents accidents.

MORE LIGHT—Degraco Sta-White, the pure white oil paint, was used by the Gilbert Paper Company, Menasha, Wisconsin, because of its amazing light-reflecting qualities and because it does stay white. Sta-White on interior walls, pillars and ceiling vastly improves working conditions, increases production and saves light bills.

100 BARRELS OF STA-WHITE—When the Champion Coated Paper Company, Hamilton, Ohio, built the largest finishing room in the world into the plant illustrated above, more than 100 barrels of Sta-White paint were used for walls, ceilings and steel in this one room alone. Certain Degraco building paints were also used for exterior painting purposes.

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OFFICES AND WAREHOUSES IN IMPORTANT INDUSTRIAL CENTERS

Industrial Developments Are Coming

By WILLIAM SIBLEY

JUST a few days ago I was talking with a man who insisted on exploiting his belief that the four-year depression, plus the strange philosophies of the "New Deal" were going to put an end to scientific research and the development of both labor-saving mechanical means and synthetic products. By itself, this conversation would have been dismissed as the fallacious reasonings of an individual. But during the past several months, I have heard this idea expressed in varying degrees by many people in all walks of life. There seems to be abroad a sort of resentful fear for improvement; engendered through the belief that any improvement will throw some men out of work—that the development of more machines, or better methods, will only continue the problem of technological unemployment. ..... Let's consider this matter, very briefly:

Put this copy of The Paper Industry on your desk and look at your hands. Spread your fingers apart. The spaces between the fingers of your left hand represent jobs which need to be filled. The fingers of your right hand represent machines. If you interlace the "machines" on the right hand with the "jobs" on the left hand, tips foremost, you will plug up all the spaces and have none left—even for men. Machines, however, do not work that way. They fill the vacancies from behind. The machines on your right hand should enter the spaces (jobs) on your left hand from the palm. And when they do, you will find that instead of filling all the vacancies with machines, you have actually made twice the number of vacancies. The machines have filled the original spaces. True, but in so doing they have also created twice as many needs—twice as many new vacancies. Constructive adjustment is the result of machines and improved methods; not destructive replacement.

It is true that during the past four years many industrial research laboratories have greatly curtailed their activities; have drastically reduced their payrolls, if not entirely closed their doors. Even the Government in Washington, "believe it or not," has reduced its research budgets. But we stand today on the threshold of vastly increased activity in these lines, and the paper mill that advances itself commercially will be the one which has the advantage of research in production, marketing and distribution.

During the next few years many new and strange alloys, plastics and synthetic products will be introduced. Some of these products will have deep-going effects. Just as a single instance, there is coming a development in metallurgy which will so reduce the price of aluminum that its application will replace structural steel in buildings, as it already has in motor-truck and railway-gondola bodies. This will make unnecessary the huge foundations and costly preparatory work in construction and stimulate building to a degree which will far more than offset the resulting drop in steel production.

In that direction, however, there are coming other developments which will expand the use of steel to new markets. Stainless and rustless steels will be made more cheaply, with the result that it logically may replace bronze now used in statues, the breakable china now used in plates, cups and saucers, the costly plate glass mirrors, or the polish-demanding brass stair rails and door fixtures.

Just around that corner at the intersection of Main Street and Prosperity Avenue are whole new industries waiting to be developed. Air conditioning is one of them; an industry which some day will be as great as our automotive industry. When both that industry and the nation at large realize they must adopt air conditioning, one step at a time (starting with humidification which is applicable in nearly every home), we will have a new billion dollar industry in short order. Television is another industry now awaiting assured purchasing power. And that (after an experimental period of a few years in which we are offered putrid shows) means the tapping of a huge reservoir of both resources and employment.

Nor is it chimerical to say that with the broadcasting of both sight and sound will come the broadcasting of power and heat, the envisioning of which is tempting to any Jules Verne. The industrial revolution instituted through the development of broadcast power is staggering to the imagination.

Let no one give credence to the belief that industrial development or scientific research will be declared on a holiday—even for one minute. Research work in the Department of Agriculture alone has proved that for every dollar spent, the nation has gained five hundred dollars—a profit of fifty thousand per cent! Research is here to stay—and upsetting developments are coming.

Drive it with
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FOR GREATER PRODUCTION PER HOUR

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Link-Belt Silent Chain is Positive, today, tomorrow, every day; and transmits ALL the power of the motor. As the driven shaft operates at the figured speed, you can also depend upon getting the rated capacity of the machine . . . . Avoid power, product and production losses through drive slippage. Modernize, and cut driving costs with a drive that can't slip—the *positive* Link-Belt Silent Chain Drive . . . . Send for Data Book 125, and Pink List 725 of complete drives carried in stock for immediate delivery.

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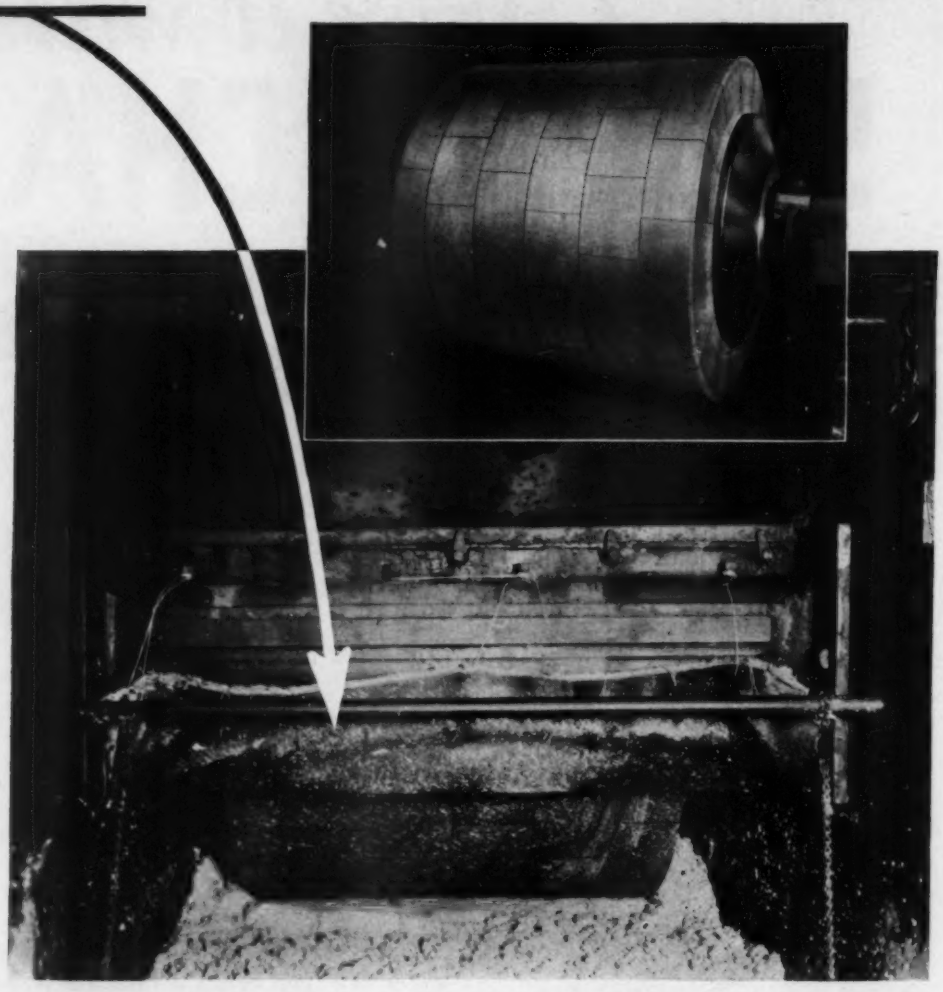

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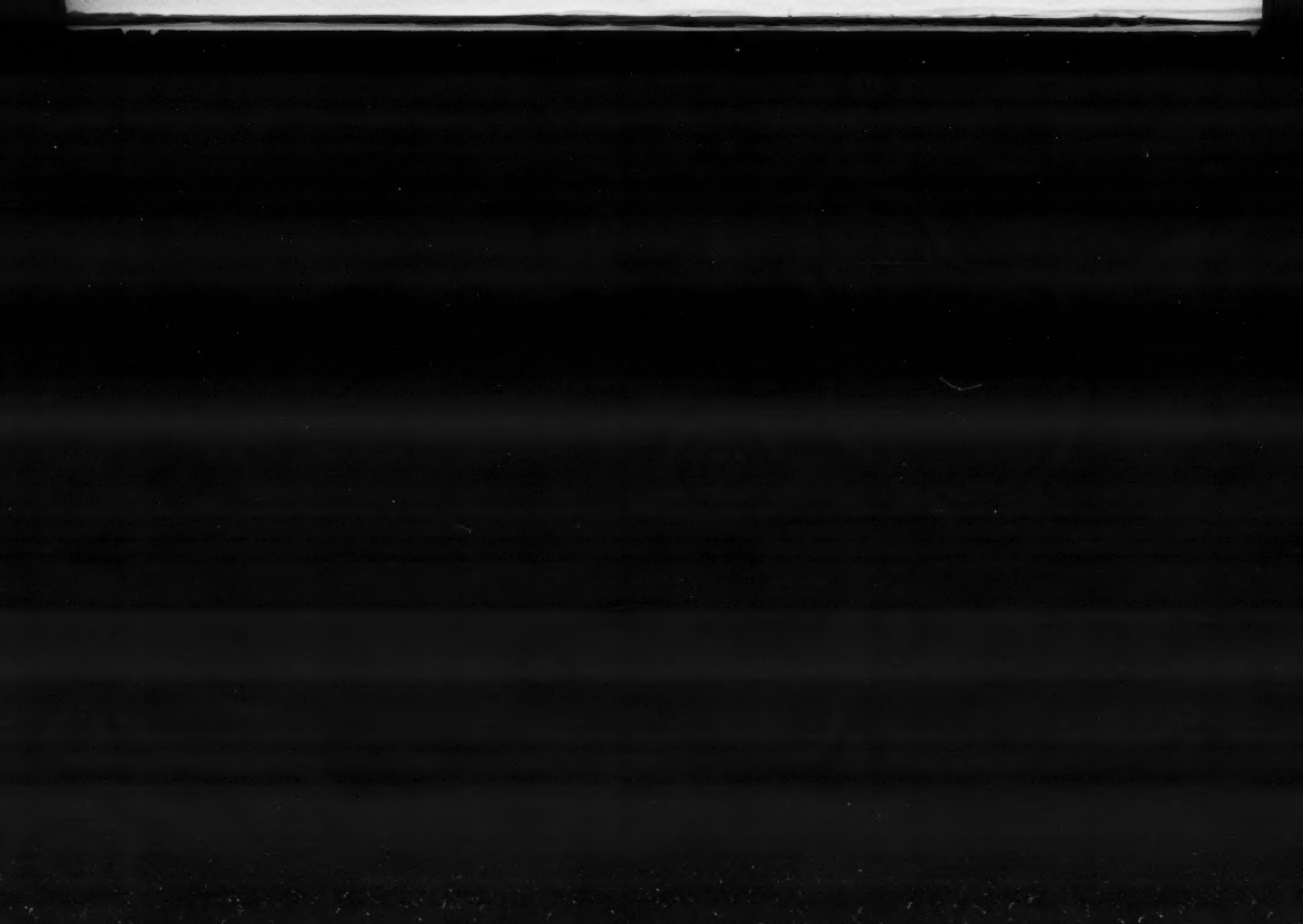

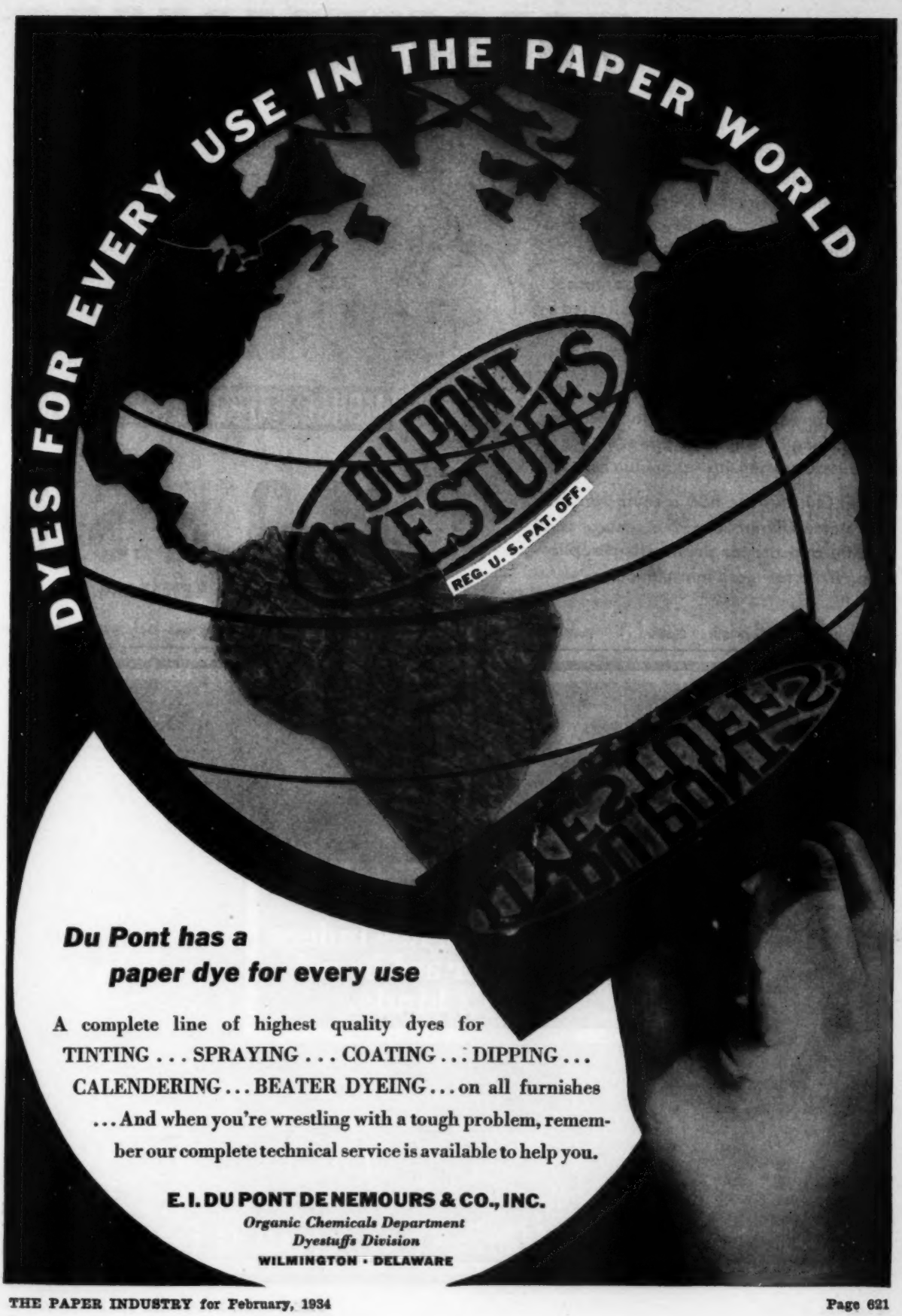

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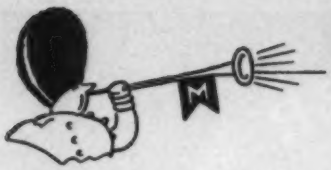

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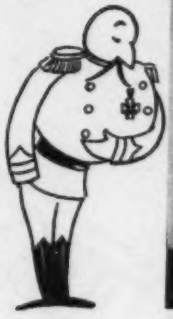

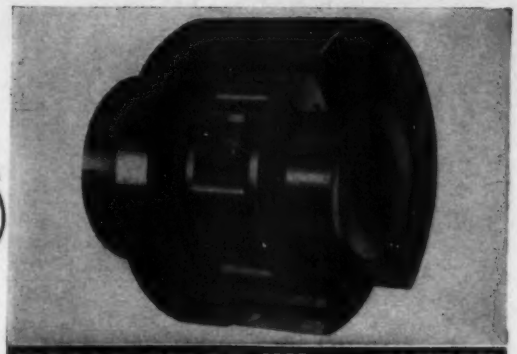

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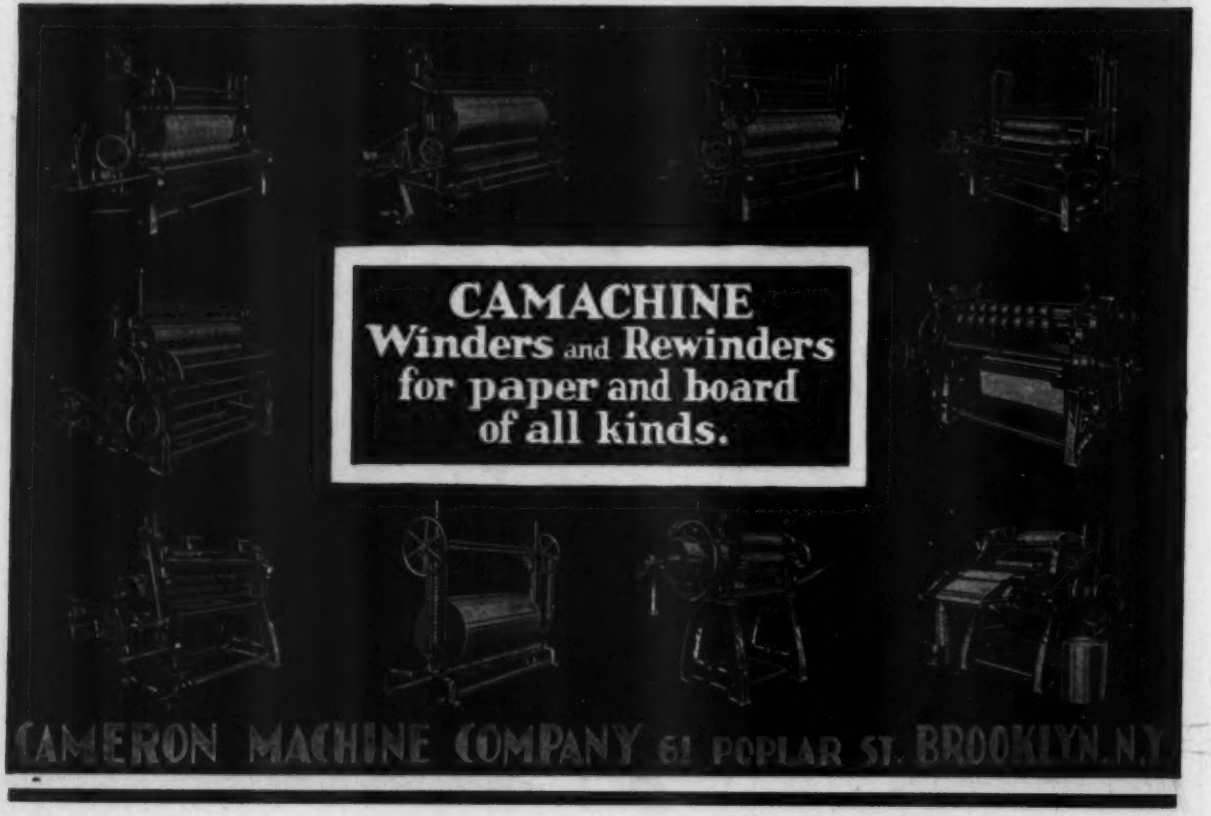

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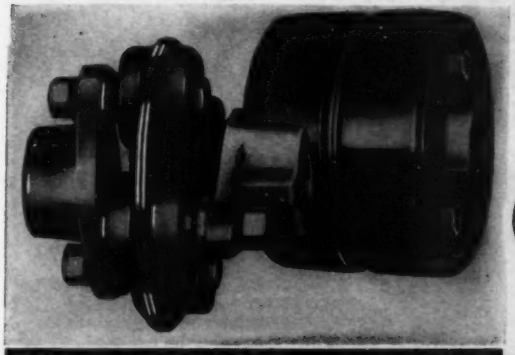

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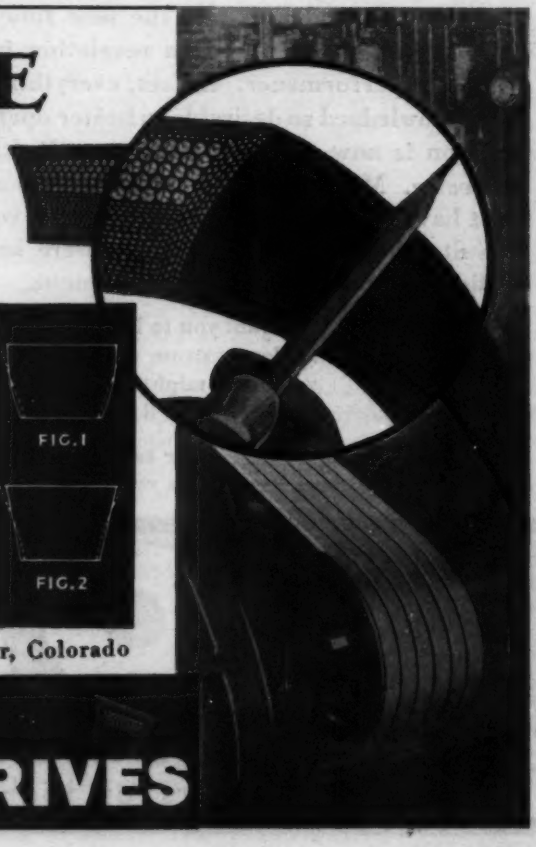

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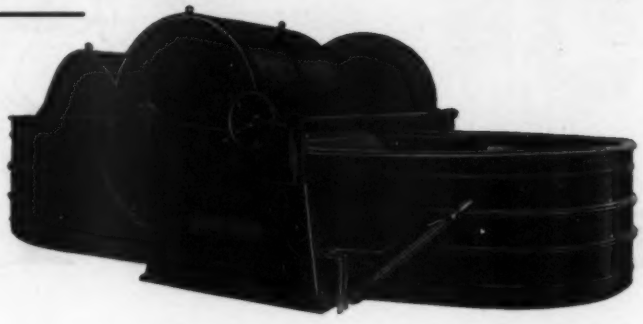

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THE PAPER INDUSTRY

A MONTHLY EDUCATIONAL JOURNAL

The Determination of The Wool Content of Paper

CHARLES A. BLAISDELL and JESSIE E. MINOR

THE available literature on the subject of how to determine the wool content of paper is meagre and unsatisfactory, and not one of the proposed methods is adequate for all kinds of wool content papers. The opinion most frequently expressed is that microscopic methods are too inaccurate for consideration except for the impregnated roofing felts for which other methods are even less satisfactory. The most accurate information for non-impregnated wool content papers is said to come from the chemical methods.

A study made in this laboratory* of the relative values of microscopic and chemical methods for determining the wool content of papers gives evidence that for such relatively pure fiber papers as are used for embossing plates for making paper napkins, as beer coasters, as filters, etc. the microscope gives more reliable evidence of the wool content than does chemical methods.

In using the dot-count microscopic method, a factor of two for wool and one for cotton will convert length to weight ratios with reasonable accuracy.

The calculations of wool content from the Kjeldahl nitrogen value gives results which most nearly accord with the furnish ratios, especially when a closed system of machine water reuse preserves the nitrogen of the structureless wool material.

Review of Methods

Of the chemical methods which have been used, the three that have received the most attention are:

1—Dissolving the wool fibers in hot caustic solution and subsequently weighing the cotton residue with an allowance of 5 per cent for the solubility of cotton in the alkali.

2—Dissolving the cotton fibers in strong acid and subsequently weighing the remaining wool fibers.

3—Calculating the wool content from the nitrogen value obtained by the Kjeldahl method.

Method 1, in which the wool content is dissolved in alkali, is often recommended for paper low in wool because of its relative ease of manipulation, but results by this method are apt to be low in wool due to the fact that in that grade of papers the cotton is usually a soft fiber for which the solubility in alkali may vary by as much as 15 per cent and the usual allowance of 5 per cent for such solution is inadequate. The alkali strength used is usually a 2 per cent solution with boiling for one hour or a 5 per cent solution with boiling for 10 minutes. This method was studied in detail by Brecht and Helmer[1] and recommended for its ease of manipulation where high accuracy is not necessary, but the study was apparently made with a harder grade of cotton fibers than are common in many wool content papers.

Method 2, in which the cotton is dissolved in acid, is recommended for papers of high wool content, and for some types of paper this method gives very good results. It is endorsed by Bruno Schultz[2] for its accuracy, though for roofing felts where fine groundwood is present he recommends a 6 per cent correction for the undissolved groundwood which adheres to the wool. The method requires a three hour cook in 80 per cent sulphuric acid with considerable stirring which renders it too troublesome for control work and, therefore, it was not considered in this study.

Method 3, in which the wool content is calculated from the nitrogen value, was recommended by Ruskowsky and Schmidt[3] in 1909 and again by Waentig[4] in 1920. The method gives very good results with either large or small amounts of wool in papers in which no glue or other nitrogen containing substance is present. The nitrogen content of pure wool, regardless of the quality or location where grown, is said to offer very little variation. Barrett[5] gives an average of 16.72 per cent, while Winton and Edgar[6] show from the examination of 29 varieties of wool a variation from 15.81 to 16.35. Our own tests on three different grades of wool averaged 16.03 per cent. For routine work, the factor of 16.0 is considered adequate.

*The above paper was prepared and written by the co-authors in the laboratory of Jessie E. Minor, 95 State Street, Springfield, Mass.

None of these chemical methods offer any satisfactory results for such papers as roofing felts because of the wide variety of fibers in the furnish. The alkali of Method 1 will dissolve considerable of the wool as well as the soft cotton, the acid of Method 2 will not completely dissolve the groundwood and the nitrogen content of these papers may have other sources than the wool fibers.

In a report of a research conducted in 1927, Lofton of the Bureau of Standards states that "an approximately correct fiber determination of saturated felts is very difficult, partly because of the number and partly because of the nature of the fibrous material used in manufacturing," and he recommends the microscopic dot-count method without the use of a converting factor as being reasonably satisfactory. Some of the larger mill laboratories are now using the microscopic estimation method but usually with a factor above one on the wool fibers.

Discussion of Experimental Results

Microscopic count methods measure a length factor only and must be converted to weight ratios by the use of factors. In order to fix the relative factors for wool and cotton, small quantities were cut to papermaking lengths, weighed, mixed, suspended in water until wetted, stained with the ordinary Herzberg stain and counted under the microscope. This work gave factors varying from 1.9 to 2.12 suggesting 2.0 as a desirable average. Comparison with the caustic and Kjeldahl methods of calculations from the microscopic method on paper samples which had been disintegrated in hot water only, using this factor of 2.0 gave results as indicated in Table I.

For these grades of paper which are made of rather pure fibrous materials, no source of nitrogen other than the wool would be expected and, therefore, the close agreement between the microscopic and Kjeldahl methods would indicate for these two methods similar value. But the caustic method, even with the recommended 5 per cent correction for the solubility of cotton in alkali, gives an error sufficiently large to noticeably affect the properties of paper and this method should not be considered for papers of this kind.

In further extending the comparison of the microscopic and Kjeldahl methods to a wider variety of these fairly pure wool content papers it was found that the microscopic method, using the factor of 2.0, gave lower results for the wool than did the Kjeldahl method. This is indicated in Table II.

These papers were all tested for animal size or casein and none was found indicating that in all probability the Kjeldahl nitrogen was from the wool only.

Papers 3 and 4 were mill made from a furnish of 60 per cent wool and 40 per cent cotton, while papers 5 and 6 were made in the same mill of 50 per cent wool and 50 per cent cotton and the wire water was not recirculated in this mill. Microscopic determinations would indicate a loss of enough more of the wool in the backwater to leave the percentage of wool in the finished paper from 5 to 7 per cent less than in the furnish.

From these figures it is apparent that much better concordance for the two samples from the same lot is shown by the microscopic method than by the Kjeldahl.

TABLE I

	Micro. Dot-Count Method Factor 2	Caustic 2 Per Cent Method Corr. for Cotton solub. 5%.	Kjeldahl Method
Fiber content,			
Wool	50%	59.6%	51.75%
Cotton	50%	40.4%	48.25%

TABLE II

Paper	Kind of Fibers	Kjeldahl Method	Micro. Results Factor 2.0	Micro. Factor to Accord With Kjeldahl
1.	Wool	20.2 %	12.3%	3.5
	Cotton	79.8 %	87.7%	
2.	Wool	39.4 %	24.5%	4.0
	Cotton	60.6 %	75.5%	
3.	Wool	57.58%	54.7%	
	Cotton	42.42%	55.3%	2.2
4.	Wool	54.83%	54.4%	2.0
	Cotton	45.17%	45.6%	
5.	Wool	52.02%	43.6%	2.9
	Cotton	47.98%	56.4%	
6.	Wool	49.98%	42.8%	2.7
	Cotton	50.02%	57.2%	
7.	Wool	48.25%	48.4%	2.0
	Cotton	51.75%	51.6%	

TABLE III

	Wool	Cotton
(a)		
Before Stirring		
1. Kjeldahl method,	57.58%	42.42%
2. Microscopic, factor for wool 2.0	54.7 %	45.3 %
3. Factor to agree with Kjeldahl,	2.2	1.0
(b)		
After Stirring, Drained,		
4. Kjeldahl method,	53.40%	46.60%
5. Microscopic, factor for wool 2.0	43.3 %	56.7 %
6. Factor to agree with Kjeldahl,	3.0	1.0
(c)		
After Stirring, Evaporated,		
7. Kjeldahl method,	57.65%	42.35%
8. Microscopic, factor for wool 2.0	43.3 %	56.7 %
9. Factor to agree with Kjeldahl,	3.6	1.0
(d)		
Per cent loss from stirring,	9.93%	1.03%

If the Kjeldahl nitrogen content is a reliable criterion of wool content of this grade of paper, then the lower wool content by the count method would indicate a variation in the relative resistance of the two types of fibers to being broken down under the beater action. Wool fibers are wetted with difficulty and are also very resilient requiring considerable drastic beater action to reduce them to papermaking condition. If, with such beating tackle, the wool fibers are broken down more than the cotton ones and the broken down material is largely lost in the backwater, microscopic or Kjeldahl analysis would indicate a lower wool content than would be expected from the furnish. But in a closed system, where the backwater is used over and over, the microscope would still indicate low for wool while the Kjeldahl nitrogen method should come much nearer the furnish figures for wool. If, on the other hand, the worn cotton fibers under the drastic beater action are more easily broken down than are the wool fibers and these broken fragments of cotton fibrils are drained off in the backwater, both methods of analysis would show high wool content. Also the

reuse of whitewater would have little effect on results and even in a closed system, both methods should give a higher wool content than expected from the furnish.

To test this theory as to the effect of beating on the relative wool content of such papers, 2 to 5 gram weights of wool and cotton fibers were mixed, counted under the microscope, then stirred vigorously with an electric stir and again counted. Each time it was found that the wool content counted under the microscope for the sample which had been stirred was less than that for the sample which had not been stirred.

To further establish this point, three equal samples of paper of number 3 of Table II were suspended each in 50 cc. of water and stirred with the electric stir for three hours, then treated as follows:

1—The fibers were counted under the microscope for wool and cotton content.

2—The suspension was filtered through machine wire with suction, dried, weighed, and the nitrogen content determined by the Kjeldahl method. In this sample the loss of weight due to stirring was also calculated.

3—The entire suspension was transferred to a Kjeldahl flask, evaporated and tested for nitrogen in the usual manner.

Results of these tests are given in Table III.

Conclusions

The evidence of this table brings out the basis of our argument and supports the following conclusions:

1—In mill beating, more wool is lost than cotton. In the laboratory stir method this loss amounted to almost ten times as much for the wool as for the cotton. Any increase in the extent or intensity of beating is apt to result in finding by analysis a lower percentage of wool in the finished product.

2—When a factor considerably larger than 2.0 is needed to bring agreement between the microscopic and Kjeldahl methods, it is probable that the Kjeldahl value has been built up by the adherence of structureless, nitrogen containing wool material to the fibers.

3—Where the machine water is recirculated, it is quite probable that this Kjeldahl value would be built up to approximately the same figure as the original furnish.

4—When the outer layer of the wool fiber has been gelatinized, the under cortical layer tends to fibrilate showing clearly under the microscope frayed ends as in cotton, but, lacking the strength to develop any long fibrils, they soon lose their structure and it is this entire gelatinized mass which accounts for the discrepancy between the Kjeldahl and microscopic methods of analysis.

5—The microscopic method gives better concordance between different samples of the same lot than does the Kjeldahl method.

6—A microscopic dot-count method, using a factor of 2.0 for wool and one for cotton gives results which are probably more nearly correct for the wool content of the finished paper than does the Kjeldahl method.

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Factors Affecting Fourdrinier Wire Life

By HARRY G. SPECHT
Eastwood-Nealley Corporation

FOR MANY years, fourdrinier wire manufacturers have conducted intensive research in an endeavor to improve the quality of their wires to secure longer wearing life on the paper machine. Metallurgical and chemical studies have been made to determine the possibilities of improving metal characteristics, and mechanical improvements in looms have resulted in the weaving of more perfect and finished wires.

There is, however, a practical side to this research problem. A wire belt is woven from brass or bronze soft wire .007 to .009 inch in diameter. Consider these small dimensions of raw material dealt with and then realize that the woven belt is run on a paper machine 24 hours a day, six days a week, at speeds as high as 1250 feet per minute for from 15 to 60 days. The average wire travels 30,000,000 feet in its wearing life. It is amazing that so fine a fabric is required to do so much work and lasts as long as it does under such trying and varying conditions. If the paper manufacturer would endeavor to understand the wire manufacturer's problem as that manufacturer has tried to understand the paper manufacturer's problem, there would be a better understanding of wire life factors and considerably more progress in wire improvement.

From a practical standpoint, the wire manufacturer, through the limiting factors which must be dealt with, can only improve wire life to a small degree, whereas the paper manufacturer, through the control of operating conditions, can increase wire life greatly. Many manufacturers have made great improvements on their paper machines, and in such cases increased wire life has resulted.

Wire Specifications Difficult to Establish

There is a tendency for paper manufacturers to become interested in wire specifications to increase wire life by specifying wire sizes, grain size in the wire used, and to specify wire elongation and strength. Wire manufacturers have gone through these details many times, and whereas one manufacturer using a certain elongation and tensile strength in his wire gets a certain finished result in the woven wire, another using the same raw materials will get a different result. This situation can easily be understood by paper manufac-

turers, because two paper mills using similar formulas and ingredients might get different finished paper results, due, of course, to operating conditions.

Tensile strength, elongation and fatigue tests have been made many times and standards set for what may be considered a perfect fourdrinier wire. Wires made according to these specifications have been shipped to various paper mills, and the variable results obtained in their life due to variable mill operating conditions are a perplexing problem to the manufacturer.

It is well to realize that the woven wire is the subject to be considered and any specifications set up are all finally measured in the life of the wire and the formation received as exemplified through the finished sheet.

Operating conditions are so varied in different paper mills that a more uniform operating condition must be established in wire operation before wire manufacturers can accomplish much in improved wire life. Consider this: There are nearly 1000 fourdrinier paper machines in the United States; less than 50 of these machines use wires of the same size, mesh and material; only a few of these machines operate at the same speed and under the same conditions.

A fourdrinier wire is a custom-made product, built to satisfy the peculiar operating conditions of each machine; therefore, there can be no such factor established as to what a standard fourdrinier wire should be. Neither can standards be set in regard to the material used in a wire, for each manufacturer has varying weaving conditions that require different material specifications.

Wire Life Variables

In addition, the following list of factors varying from mill to mill and from machine to machine affect wire life:

Sheets varying from 15 pounds to 150 pounds are being made by many mills on the same wire.

Oscillating suction boxes are used in some mills, others prefer stationary suction boxes.

While one type oscillator is chosen by one mill, some favor another.

Both flat suction boxes and curved boxes are used.

Metal suction box tops are utilized, as well as wood. Holes and slots vary.

There are mills that use dandy rolls and mills that do not. The location of the dandy roll, where used, varies. Some locate it in relation to the suction box; some do not.

Some mills sour their wires, some do not. Various souring solutions are used.

Speeds vary from 60 to 1250 feet per minute.

There are acid conditions in one mill, alkaline conditions in another.

Some machines are equipped with small driving and breast rolls, some with large diameter rolls.

One may find suction rolls on one machine, plain rolls on another.

Some machines have small rolls with top felt couches.

Liberal sprays are used on the wires of some machines to keep them clean of grit; others have small sprays or none. Yet grit, clay and filler greatly affect wire life.

Roller bearing table and stretch rolls are used in some instances; in others plain bearings are used. Bearings are often neglected. Some table rolls do not even turn.

Equalizing stretch roll adjustments are used by some so that both stretch roll bearings move equally. Some have separate adjustments for each side of the roll, tending to create uneven operation of the wire.

Some have free turning supporting rolls for the wire, others do not.

Suction rolls permit wire slippage from 2 to 10 per cent.

Vacuums vary greatly in type of paper being made, the wire taking the brunt of the vacuum requirements.

Wire guides vary greatly and affect wire edges to a great extent. Most edge cracking is due to wire guides.

Deckle straps greatly affect wire life, especially edges.

The amount of apron surface resting on the wire affects wire life.

No standardization of the running tension of the wire is maintained, varying with no control from wire to wire.

The co-ordination and correction of these factors to the proper condition for each particular machine will greatly increase wire life and give more uniform results. When considered in the light of variation in different mills, the problem of the wire manufacturer is apparent.

Wires are woven under fairly uniform conditions. Yet the varying results obtained on the paper machines are a testimony to varying mill operating conditions and not wire conditions, for the wire record of each machine shows variations for which the wire cannot be held accountable.

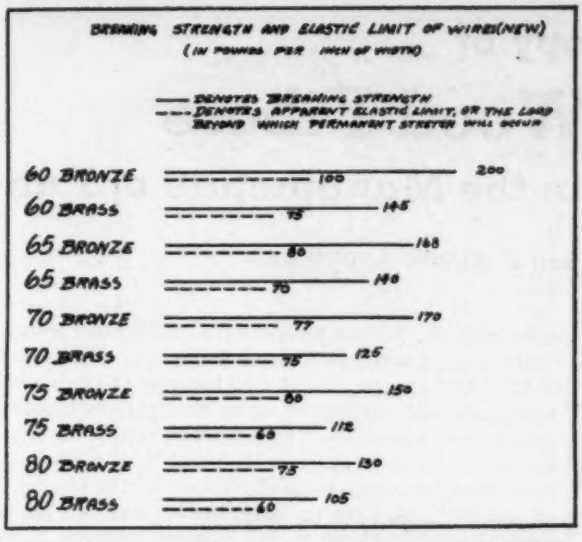
With the same factors in mind and in an attempt to control standardized conditions, data have been gathered to establish running tension on a wire and to design a unit for measuring such running tension.

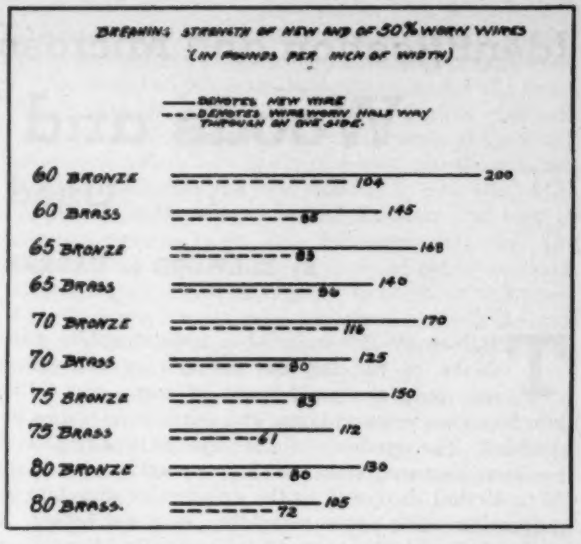
A wire should not be stretched beyond, or even run near to, its elastic limit. As the wire wears, its strength diminishes. Therefore, wires should not be run at as high a tension when worn as when new. As a wire wears, its bearing surface area greatly increases. This increase in bearing area affects slippage on the driving and breast roll and each mill should vary the running tension of the wire in relation to this factor. In other words, the running tension of a wire should be maintained great enough to prevent slippage on the driven roll, and yet excessive tension is just as detrimental to a wire as insufficient tension.

Samples of woven wires of various meshes have been tested to determine the elastic limits and tensile strengths of new half-worn and fully-worn wires. The accompanying charts illustrate these comparisons for wires of various meshes and metals.

In analyzing the charts, it will be noted that the elastic limits of a new wire are approximately 50 per cent of the tensile strength. The variations above and below the 50 per cent average are due to the variations in the samples tested. It will also be noted that brass wires are lower in tensile strength than bronze wires of a similar mesh. Yet, in many mills, brass wires will outrun bronze wires in wire life, indicating that tensile strength is not the determining factor in wire life. Diameter and size of rolls are factors in this regard.

Experimental work is being carried on in regard to the effect that different clays and fillers have on wire life. Thus far, results have been surprising. Abrasive


BREAKING STRENGTH AND ELASTIC LIMIT OF WIRES(NEW)
(IN POUNDS PER INCH OF WIDTH)
—— DENOTES BREAKING STRENGTH
---DENOTES APPARENT ELASTIC LIMIT, OR THE LOAD BEYOND WHICH PERMANENT STRETCH WILL OCCUR
60 BRONZE 100 200
60 BRASS 75 145
65 BRONZE 80 168
65 BRASS 70 140
70 BRONZE 77 170
70 BRASS 75 125
75 BRONZE 80 150
75 BRASS 60 112
80 BRONZE 75 130
80 BRASS 60 105


BREAKING STRENGTH OF NEW AND OF 50% WORN WIRES
(IN POUNDS PER INCH OF WIDTH)
—— DENOTES NEW WIRE
---DENOTES WIRE WORN HALF WAY THROUGH ON ONE SIDE.
60 BRONZE 104 200
60 BRASS 85 145
65 BRONZE 83 168
65 BRASS 96 140
70 BRONZE 116 170
70 BRASS 80 125
75 BRONZE 83 150
75 BRASS 61 112
80 BRONZE 80 130
80 BRASS. 72 105

effects of clays and fillers have varied as much as 1000 per cent in wire life. These results are based on laboratory tests, but such tests indicate a practical application that individual mills should investigate.

Tests have been run to determine the abrasiveness of different abrasives on various alloy mixtures. In these tests, certain types of alloys have shown greater affinity for certain abrasives than for others.

There is likewise a field for experimental work on suction box covers to determine the effect that such covers have on wire life. Data are being gathered for the conducting of such a test in conjunction with the alloy and abrasive tests.

Furthermore, the stretch roll in most mills is a greatly neglected factor in wire life. As the running tension in a wire should be maintained through such control, mills are permitting the roll to rest on the wire without control, out of level and running in poor bearings. Such mills as properly control their stretch roll greatly add to their wire life.

Recommendations for Increasing Wire Life

Might it be recommended that there should be established for each machine the proper running tension for each type of paper to be made upon it, the correlating vacuum and the operating speed for a given wire of a specified mesh. This tension should be duplicated on each wire used, and the variable factors eliminated. Such control will work for more uniform wire life and greatly add to the total wire life secured over a period of time.

Suction roll slippage should be eliminated.

Table rolls, bearing and stretch rolls should be free turning.

Aprons should be properly set and maintained.

Suction box covers should be properly shaped and maintained.

Dandy rolls should be supported in relation to suction boxes.

Liberal water sprays should keep wires clean of grit and filler.

Oscillating boxes should replace stationary boxes and they should be of the correct type.

Souring and cleaning of wires should be controlled.

Breast and driven rolls should be of sufficient diameter and free turning.

Top couches should be eliminated, if possible, or very carefully maintained in relation to supporting rolls and with suitable firm coverings.

Stretch rolls should be equalized in adjustment of wire.

Deckle straps and wire guides should be carefully checked and maintained.

Sulphite Bond Research

THE Bureau of Standards has reported the results of paper making experiments on the manufacture of bond paper from sulphite wood fibers. This work was one of a series of studies to obtain more definite knowledge of the relation of the characteristics of fibers and of their treatment to the stability and strength of record papers.

Study of the mechanical treatment of the fibers, the "beating" operation, outlined conditions whereby paper of maximum strength was obtained without impairment of other desirable properties, such as stability and opacity. The Bureau states that very careful control of this operation is necessary for the best results. Study of the influence of the various sizing materials used to impart good writing quality and other desirable properties yielded some interesting results. As was the case with other types of fibrous raw materials, careful control of the amount of alum, was found necessary. Too much acidity from alum adversely affected the stability of the papers, as judged by the heat test, but when the minimum amount for satisfactory writing quality was used, the stability of the papers was not impaired.

Unlike papers made from stronger and purer fibers, the stability of these sulphite papers was not adversely affected by rosin, and was improved very little by surface sizing them with glue or starch. Starch incorporated in the paper stock increased the folding endurance somewhat, but the surface sizing treatment had little effect in this respect.

Identification and Microscopy of
Woods and Wood Fibers
Used in the Manufacture of Pulp

By ELLWOOD S. HARRAR[1] and J. ELTON LODEWICK[2]

THE recent demands for a more complete utilization of the log has resulted in converting into pulp the wood waste of many saw mills, box factories, veneer plants, and other wood using industries. The number of timber species thus employed has been increased from year to year until today some 30 to 40 find their way to the grinders or digesters in pulp mills. The paper technician, as never before, is confronted with the necessity of correctly identifying many new raw materials either in the form of bolts, chips, lap pulps, or even heterogeneous fiber masses. A positive recognition of such materials is not infrequently attained with difficulty, but as a general rule accurate determinations involving the use of microscope may be made with little or no effort, providing, of course, that one has a clear conception of wood structure and its range of variation.

Source of Pulpwoods

Botanically, wood is produced in commercial quantity by two large classes of plants, commonly known as the *Gymnosperms* and the *Angiosperms*. The former include the conifers or cone-bearing species. These are characterized by scale-like or needle-like resinous leaves which, except for those of the larches and southern cypresses, persist for several seasons. Other members of this group which should be mentioned are the pines, spruces, hemlocks, firs, and cedars. The hardwood or broadleaved *(angiospermous)* trees include the gums, cottonwoods, maples, and others, the leaves of which are normally flattened expansions of tissue, non-resinous for the most part, and in the cooler regions at least, persistent for but a single season. These and other characteristics too numerous to mention serve readily to distinguish the two groups of plants. Coupled with the external difference between conifers and hardwoods, (as the broadleaved forms are also known), are variations in wood structure which are as equally well defined.

Wood, unlike stone, steel, or cement all of which are more or less homogeneous materials, is composed of microscopic cells, the type, size, and arrangement of which is characteristic for any given species. Structurally, coniferous woods are less complex than are those of the hardwood group. As will be shown later they are *non-porous*, frequently resinous, and consist largely of fibrous elements. Hardwoods, on the other hand, are known in the trades as the *porous* woods. They are not infrequently composed of many types of cells with the fibrous components occasionally constituting only a small portion of the whole. The woods of these two groups exhibit a wide range of anatomical variations; accordingly, it seems desirable to consider each group separately. Before doing so, however, it also seems desirable to make one point clear. The term wood fiber has often been applied rather generally to all woody tissue. On the other hand, there are many types of woody cells which are in no way fibrous, hence cannot be classified as such. The terms fibrous tissue, or fibers as used in this and subsequent articles of this series refer only to those elements exhibiting a filiform or truly fibrous shape.

Gross Features of Wood

Wood is the substance making up the major part of the stems of shrubs, trees, and other so-called woody plants. Like other plant tissues it is composed of individual cells, or elements, closely bound together to form an integral unit. Variations in the gross and minute structure give the wood from each tree characteristic properties and appearances which not only fit the tree for certain uses but also provide features by which one wood may be distinguished from another.

One may become familiar with the gross features of wood by examination of a bolt of pulpwood. Cuts perpendicular to the axis of the tree, illustrated by the ends of the bolts, are known as *cross* or *transverse sections*. Longitudinal cuts made parallel to the radii of the tree trunk are known as *radial sections*, while longitudinal cuts at right angles to these are *tangential sections*.

The striking feature of the cross-section, in most woods, is its division into concentric circles. Each of these circles represents the wood formed during one year, hence are referred to as growth rings, annual rings or *seasonal rings*. In some woods, the seasonal rings are ill-defined and indistinct, but are nevertheless present in all woods grown in temperate climates. Each seasonal ring consists of two parts. The inner zone which appears lighter in color, softer in texture, and in which pores or orifices may be visible is the *springwood*. The outer zone which appears darker in color and denser in texture is the *summerwood*.

In some woods there is a marked difference in color between the center and the outside of the bolt, the center being darker. The outer layers are known as *sapwood*, the central portion as *heartwood*. The color of the heartwood and occasionally that of the sapwood may be useful in identification. In a few woods there is little or no color difference between heartwood and sapwood.

Extending outward from the pith along the radii are

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This is the first of a series of articles by these co-authors. Subsequent articles will appear in future issues of this magazine.

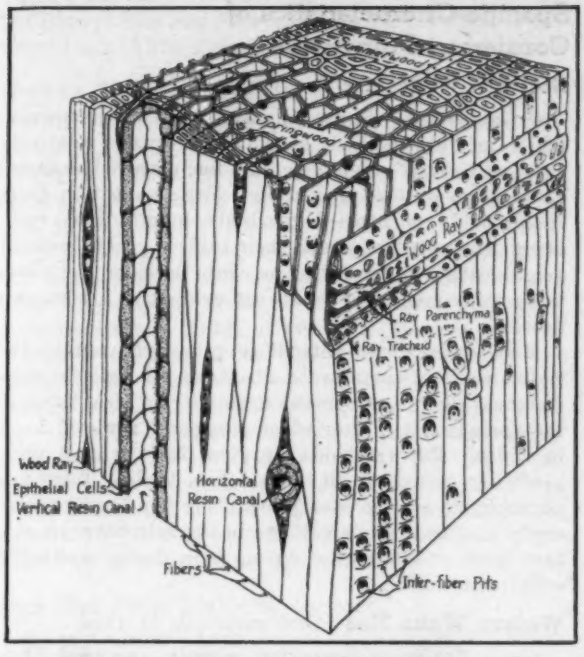


Fig. 1—Diagrammatic composite depicting the microscopical features of the wood of a hard pine

fine to relatively coarse lines of tissue, along which radial checks frequently occur during seasoning. These lines are the *wood rays,* sometimes called pith rays or medullary rays, whose structure will be discussed in more detail later.

Examination of the cross-section under magnification shows that in some woods the elements appear to be quite uniformly rectangular in section and arranged in radial rows. Woods of this type belong to the *non-porous* coniferous or softwood group. Other woods show little radial arrangement and the elements vary in size, some of them appearing as circular or oval pores or orifices. These are known as *porous* woods and are characteristic of the hardwood species.

The radial and tangential surfaces of wood show fewer gross features than does the cross section. The arrangement of the elements may give rise to a lustre characteristic of certain woods, or there may be other markings that aid in identification.

Pertinent Features of Coniferous Woods

It has been noted previously that softwoods or coniferous woods were characterized by the radial arrangement and the uniformity in shape of their elements as seen in cross section. These woods are made up largely of one type of element, designated by technologists as tracheids, but usually known as fibers in the trade. These fibers comprise from 80 to 96 per cent of the total volume of the wood, and are practically the only elements appearing in chemical pulps.

When viewed under magnification, the fibers are seen to be elongated prismatic elements with tapered ends and bordered pits; (Figures 1 and 2) i. e. pits that appear as an orifice surrounded by a circle. As seen in cross section, they are normally rectangular; in tangential section they gradually taper to a relatively sharp point; in radial section they have nearly parallel sides and somewhat blunt or occasionally forked ends.

The bordered pits serve as connections for the transfer of liquids between contiguous fibrous elements. They are more common on the radial walls of the fibers, occurring here in both the springwood and the summerwood. Bordered pits are seldom if ever found on tangential walls of springwood elements but may or may not occur on these walls in the summerwoods. The pits are normally arranged in rows one above the other, although they may be staggered, in pairs, or in 3's and 4's. They are usually more numerous towards the ends of fibers, and may appear in pairs at this point in woods which normally do not exhibit pairing.

At intervals along the fibers are groups of pits without evident borders. These are the connections between fiber and cells of the wood ray which will be described in the paragraphs devoted to a discussion of the wood ray features.

Variations in the thickness of the fiber walls will be noticed. Fibers from the springwood have thin walls; those from the summerwood have thick walls. As a rule, the summerwood fibers are narrower radially than are those from the springwood. Narrow elements and thick walls give a larger proportion of wood substance and a smaller proportion of cell cavity on the summerwood which accounts for the denser appearance of this portion of the seasonal ring. If the walls increase in thickness rather gradually throughout the ring, there is no marked boundary between springwood and summerwood. But in many woods this transition is abrupt, leading to a well-defined band of summerwood in each seasonal ring.

The wood rays in coniferous woods are flat bands of cells from one to two cells in thickness (those including

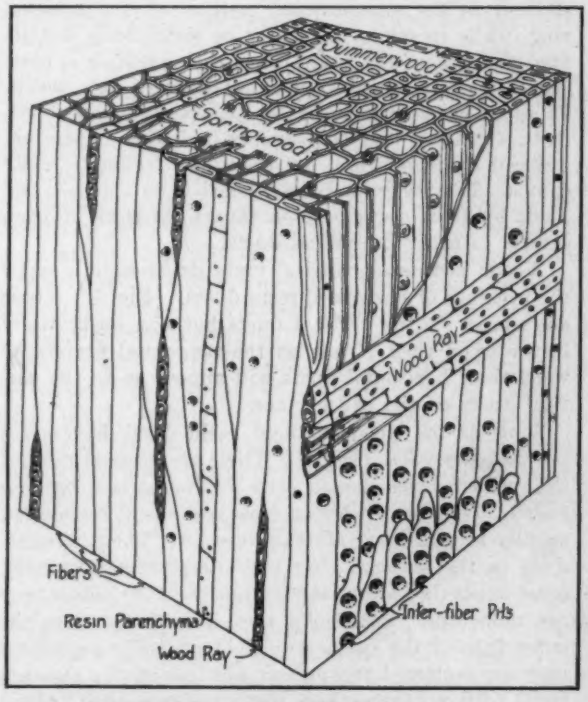


Fig. 2—Diagrammatic composite depicting the microscopical features of white fir wood (Abies sp.)

resin ducts excepted) and from few to many cells in height, extending along the radii from the center toward the outside of the tree. The cells making up the rays are brick-shaped with the end walls upright or slanting, and with their long axes radial. The rays appear on cross-sections as a narrow strip one or two or several cells in width. In radial sections they appear as bands resembling the face of a brick wall, while in tangential sections they may be recognized as storied rows of cells. (Figures 1 and 2.) Several features of ray structure are of diagnostic value. The rays may be made up entirely of one type of cell characterized by simple porous pits connecting the cells with each other and with contiguous fibrous elements. These are *ray parenchyma* cells. In some woods, a second type of cell, the *ray tracheid,* is found. This is characterized by the presence of bordered pits connecting adjacent ray tracheid cells, and connecting them with contiguous fibrous elements. When present in a wood the ray tracheids may be confined to the top and bottom of the ray *(marginal)* or may be scattered apparently hit and miss among the ray parenchyma cells *(interspersed)*. The walls of the ray tracheids may be relatively uniform in thickness or may be irregularly thickened so as to give them a *dentate* or toothed appearance.

In certain woods, such as the pines, Douglas fir, spruce, and larch, there are structures appearing as minute white dots on the ends, and as fine dark lines on radial and tangential faces of the wood. Upon magnification, these appear as oval or circular vertical ducts, surrounded by somewhat irregularly shaped resin-secreting cells. These structures are known as *resin ducts* or *resin canals.* The resin-secreting cells, *epithelial* cells, may be relatively thin-walled or thick-walled depending upon the wood in which they occur. In some species of wood the resin canals may be restricted to the summerwood portion of the seasonal ring, while in others they may be *universally* distributed throughout the ring. Thus their position is occasionally useful in distinguishing between two woods. In some woods not normally possessing resin ducts, these structures may occasionally be found. These are induced by injury and are known as *traumatic* resin canals. They may be distinguished from normal resin ducts by their occurrence in tangential rows of from several to many individual ducts.

Woods possessing vertical resin ducts usually show the presence of horizontal resin ducts. (Fig. 1.) These are similar to the vertical ducts but run horizontally in the wood rays. Thus on the tangential surface of wood these horizontal ducts will appear as do the vertical ducts on the end surface.

Some of the woods without resin ducts have *resin parenchyma cells.* (Fig. 2.) These are vertical rows of thin-walled, brick-shaped cells producing and bearing resins. They are visible on cross sections as rectangles, usually brownish or yellowish in color. Their arrangement in the seasonal ring is of diagnostic value. In some woods they are relatively sparse; in the others they are numerous. Sometimes they are restricted to the outer face of the summerwood *(terminal);* sometimes they are scattered throughout portions of the seasonal rings *(diffuse);* sometimes they appear in well defined tangential bands *(zonate).*

Specific Characteristics of Coniferous Pulpwoods

Northern White Pine *Pinus strobus L.*

Gross features—Sapwood white, heartwood brownish white to light pinkish brown or reddish; relatively soft and light in weight; medium fine textured, seasonal rings more or less uneven in width; transition from spring to summerwood gradual; longitudinal resin ducts relatively abundant, their orifices visible without magnification or appearing as white flecks on the x-section; transverse resin canals not evident at low magnification.

Minute anatomy—Inter-fiber pits restricted to the radial walls in springwood fibers, on all walls in summerwood fibers but somewhat smaller in size, those in the springwood in storied or staggered rows of 1 pit in width. Ray tracheids marginal for the most part, profusely pitted on all walls. Pits leading from ray parenchyma cells to contiguous fibers window-like, generally one, less frequently two in the field between contact faces. Cells bordering on resin ducts (epithelial cells) thin-walled.

Western White Pine *Pinus monticola* D. Don.

Gross features—Somewhat coarser textured than Northern white pine, but otherwise similar to it.

Minute anatomy—Similar to the above except that the bordered pits in the springwood fibers are occasionally in pairs across the radial walls.

Sugar Pine *Pinus lambertiana* Douglas (Fig. 3)

Gross features—Sapwood yellowish white, heartwood yellowish to reddish yellow or light brownish yellow, with a sweet sugary odor; soft and relatively light in weight; very coarse textured; seasonal rings of nearly uniform width; transition between spring and summerwood gradual; longitudinal resin ducts large, abundant, their orifices plainly visible without magnification, appearing as dark brown to blackish streaks along the face of boards; transverse resin ducts numerous, not infrequently appearing as dark specks or dots along the grain.

Minute anatomy—Similar to the white pines except

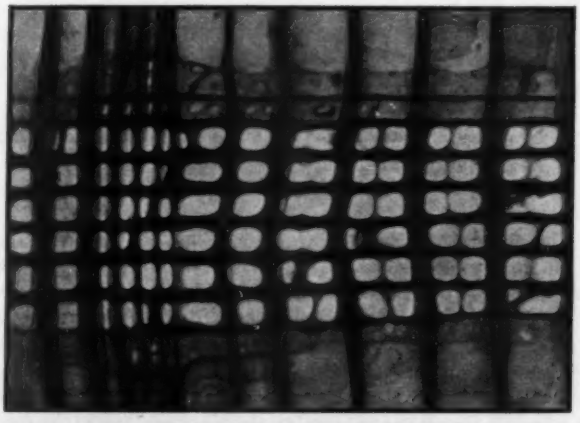


Fig. 3—Radial section of Sugar pine, X-210. Note the large window-like pits in the ray parenchyma cells. Small bordered pits may be seen in the ray tracheids. A large bordered pit appears immediately below the ray on the first fiber in the springwood

that, (1) the inter-fiber pits (in the springwood), and (2) the window-like pits between ray parenchyma cells and fibers (also in the springwood) are commonly in pairs.

Norway Pine *Pinus resinosa* Sol

Gross features—Sapwood yellowish, heartwood yellowish to reddish brown, somewhat oily to the touch; moderately hard but relatively light in weight; seasonal rings of variable width; transition between spring and summerwood rather abrupt; longitudinal resin ducts prominent, their orifices occasionally visible without magnification, but more commonly appearing as white to yellowish, flecks on the x-section. Transverse resin canals not visible at low magnification.

Minute anatomy. Inter-fiber pits restricted to the radial walls in both spring and summerwood fibers, usually in single or double, more or less staggered rows. Ray tracheids marginal for the most part, infrequently interspersed, their walls toothed (dentate). Pits leading from ray parenchyma cells to contiguous fibers window-like, and in this respect differing from the other hard pines to be subsequently described. Cells bordering on resin ducts thin-walled.

Jack Pine *Pinus banksiana* Lambert

Gross features—Sapwood white to yellowish, heartwood light brownish white to reddish brown or straw-colored; relatively soft and light in weight; transition from spring- to summerwood variable, gradual to rather abrupt; longitudinal resin ducts numerous but largely restricted to the medial portion of the ring, appearing as small yellowish to whitish dots on the x-section, their orifices not visible without magnification; transverse resin ducts occasionally appearing as brownish dots on the face of boards.

Minute anatomy—Inter-fiber pits restricted to the radial walls in both spring and summerwood, usually in uniseriate storied or staggered rows. Ray tracheids marginal and greatly interspersed, their walls coarsely toothed. Pits leading from the ray parenchyma to fibers crowded, broadly lenticular (lens shaped) for the most part, sometimes coalescent to form window-like pits. Cells bordering on resin ducts thin-walled.

Ponderosa Pine *Pinus ponderosa* Lawson

Gross features—Sapwood white to yellowish, heartwood yellowish to reddish yellow or reddish brown; soft and relatively light in weight; coarse textured; transition from spring- to summerwood abrupt, the summerwood restricted to a narrow band on the outer margin of the seasonal ring; longitudinal resin ducts abundant, somewhat more numerous in the springwood, their orifices plainly visible without magnification, commonly appearing as brownish streaks along the face of boards.

Minute anatomy—Inter-fiber pits restricted to the radial walls in both spring and summerwood, commonly in pairs or in 2-3 staggered rows along the fiber. Ray tracheids marginal for the most part, their walls more or less inconspicuously dentate, sparingly pitted fibers broadly lenticular to slit-like, somewhat distinct. Cells bordering on resin canals thin-walled.

Southern Yellow Pines Including:

LONGLEAF PINE, *Pinus palustris* Miller. (Fig. 4.)
SHORTLEAF PINE, *Pinus echinata* Miller.

Fig. 4—Radial section of Longleaf pine, X-210. Note the several rows of toothed (dentate) ray tracheids. This is a characteristic of all hard pine and serves as a positive means in distinguishing between them and woods of the soft pine group

SLASH PINE, *Pinus caribaea* Morelet.
LOBLOLLY PINE, *Pinus taeda* L.

Because of the great physical and anatomical similarity exhibited by the woods of this group, it is impossible to give characteristics of diagnostic value which may be used to distinguish between them. For this reason the following description has been so compiled as to include all of them. Longleaf pine wood is probably the hardest and heaviest of the group, but its gross and minute features are frequently so similar to the others that it cannot always be identified with certainty. Lobolly pine wood, on the other hand, is the lightest in color and weight. Because of its rapidity of growth, wide rings are to be encountered which are of material aid in identifying the species. This characteristic, however, should not be relied entirely upon as second growth shortleaf pine will also develop wide rings particularly in the early development of the trees.

Gross features—Sapwood white to yellowish, heartwood, yellowish, reddish brownish, or reddish brown to very dark brown; moderately hard to very hard and generally rather heavy, the hardest specimens almost flint-like in nature; seasonal rings extremely narrow (typical of longleaf pine) to very wide (typical of lobolly pine); transition from spring to summerwood very abrupt; longitudinal resin canals very large, their orifices plainly visible without mgnification, commonly appearing as brownish streaks along the face of boards.

Minute anatomy—Inter-fiber pits restricted to the radial walls in both spring and summerwood, in uniseriate rows, staggered, or paired in the springwood fibers. Ray tracheids marginal and interspersed, their walls strongly dentate and sparingly pitted. Pits leading from ray parenchyma cells to contiguous fibers broadly lenticular to slit-like, occasionally coalescent. Cells bordering on resin ducts thin-walled.

Eastern Spruces

Including:
RED SPRUCE, *Picea rubra* Link.
WHITE SPRUCE, *Picea glauca* (Moe.) Voss.

These two species produce woods which are quite similar both physically and anatomically. Red spruce

Fig. 5—Tangential section of Sitka spruce, X-210. The central cavity in the large ray is a transverse resin canal. Rays of this type are called fusiform and are characteristic of all spruces, pines, larches and Douglas fir

is a relatively fine textured wood, while white spruce, on the other hand, produces wood which is somewhat coarser. For reasons herein mentioned no attempt will be made to distinguish between them.

Gross features—Sapwood undifferentiated from the white heartwood; odorless; with a pearly lustre along the grain; fine to coarse textured; transition from spring to summerwood very gradual; longitudinal resin ducts very sparse; their orifices not visible at low magnification (10x); transverse resin ducts sparse but frequently in evidence at low magnification through a darkening of their contents.

Minute anatomy—Inter-fiber pits restricted to the radial walls in springwood tracheids, those on the tangential walls in the summerwood sparse and minute. Ray tracheids marginal, sparingly pitted. Pits leading from ray parenchyma cells to contiguous fibers very small, somewhat distant, oval to angular (piciform). Transverse resin ducts of nearly the same size as the longitudinal ducts. Cells bordering on resin ducts (epithelial cells), thick-walled.

Engelmann Spruce *Picea engelmannii* Engl.

Engelmann spruce, similar structurally and physically to eastern white spruce, is a western species.

Sitka Spruce *Picea sitkensis* (Bongard) Carriére. (Fig. 5)

Gross features. Sapwood light straw-colored to whitish, heartwood pinkish brown to reddish brown, or brownish white; with a silvery to pearly lustre; relatively coarse textured; longitudinal resin ducts appearing as white dots on the x-section, occasionally in short tangential rows of 3—several.

Minute anatomy. Similar to that of spruces described above.

Douglas Fir *Pseudotsuga taxifolia* (LaMarck) Britt. (Fig. 6)

Gross features—Sapwood white to brownish white, heartwood yellow, yellowish brown, reddish brown, purplish brown, or reddish brown; with a characteristic odor; relatively soft to hard and moderately heavy; seasonal rings of nearly uniform width; transition from spring to summerwood abrupt; longitudinal resin ducts relatively sparse, of variable diameter, usually oval in x-section, commonly paired at in rows of 6-7, their orifices not visible without magnification.

Minute anatomy—Inter-fiber pits restricted to radial walls in the springwood, present on all walls in summerwood, those in the summerwood smaller. Spiral thickening present in both spring and summerwood. (These structures should not be confused with spiral checks which frequently occur in the summerwood fibers of the hard pines and other of the denser coniferous woods). Longitudinal resin parenchyma cells present but very sparsely, restricted to an occasional cell on the outer face of the summerwood (terminal) as seen in the x-section. Ray tracheids strictly marginal, frequently containing minute spiral thickening. Ray parenchyma cells with very small, distant, oval to circular pits. Cells bordering on resin ducts (epithelial cells) thick-walled.

Tamarack *Larix laricina* (Du Roi) Koch.

Gross features. Sapwood yellowish, heartwood golden-brown to yellowish-brown, never tinged with red or reddish hues; more or less oily to the touch; seasonal rings of variable width; hard and moderately heavy transition from spring to summerwood very

Fig. 6—Radial section of Douglas fir, X-210. Note the spiral thickenings and the frequent cell wall checks between bordered pits

abrupt; longitudinal resin ducts sparse, small, their orifices not discernible without magnification.

Minute anatomy. Inter-fiber pits restricted to radial walls in springwood fibers, those on the tangential walls of summerwood fibers sparse and very small. Spiral thickening similar to those observed in Douglas fir and very rarely present in the summerwood fibers. Longitudinal resin parenchyma very sparse, occurring as an isolated thin-walled cell in the thick-walled summerwood. Ray tracheids strictly marginal, shouldered at one and occasionally at both ends, sparingly pitted. Pits leading from ray parenchyma cells to contiguous fibers similar to those noted in the spruces. Cells bordering on resin ducts (epithelial cells), thick-walled.

Western Larch *Larix occidentalis* Nutt.

Gross features—Sapwood yellowish to light straw-colored, heartwood reddish brown, reddish, or dark golden-brown; slightly oily to the touch; moderately hard; coarse textured; seasonal ring narrow of nearly uniform width; transition from spring to summerwood very abrupt; longitudinal resin ducts generally very sparse, occasionally, however, occurring in great numbers; very small, their orifices not visible at low magnification (10X).

Minute anatomy—Similar to that of *Larix laricina*.

A characteristic of all the woods just described is the presence of longitudinal and transverse resin ducts, the latter always occurring in the rays. These structures are normally absent in the woods yet to be considered, but under certain conditions they are occasionally to be found in the true firs and hemlocks. In these woods the ducts are traumatic. As they are never accompanied with transverse resin ducts it is a simple matter to determine whether or not they are normal to the wood. The term resin cell should not be confused with resin duct. Resin cells are those parenchyma cells which are heavily infiltrated with resinous material. Such cells are common to redwood, bald cypress, and many of the cedars.

Eastern Hemlock *Tsuga canadensis* Carr. (Fig. 7)

Gross features—Sapwood whitish, heartwood pinkish-white light brownish white, or occasionally with a purplish tinge; with an extremely rancid odor when freshly cut but mellowing somewhat with age; hard, very brash or splintery, but relatively light in weight; transition from spring to summerwood abrupt; resin ducts normally absent.

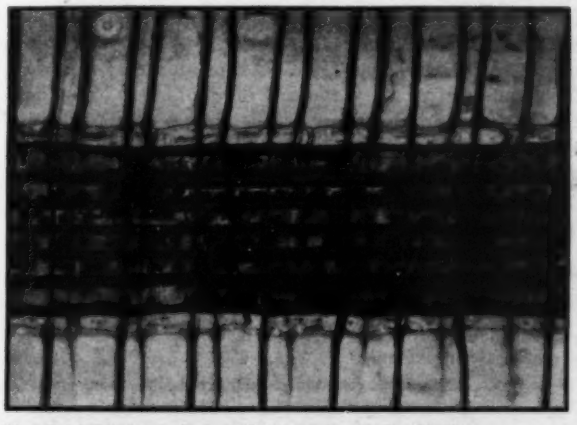


Fig. 7—Radial section of Eastern hemlock, X-210. Note the thin-walled ray tracheids and the much thicker-walled ray parenchyma cells. One is apt to overlook the former if not careful as they are not readily observed in unstained material. Their presence or absence, however, is frequently the determining factor in distinguishing between the wood of hemlocks and that of true firs

Minute anatomy—Inter-fiber pits restricted to radial walls in the springwood, present on both walls in the summerwood, those of the tangential walls sparse and minute. Longitudinal resin parenchyma very sparse, generally occurring as a solitary cell or in 2's or 3's on the outer face of the summerwood. Ray tracheids generally marginal, rarely interspersed. Pits leading from ray parenchyma cells to contiguous tracheids similar to those in spruce, Douglas fir or larch.

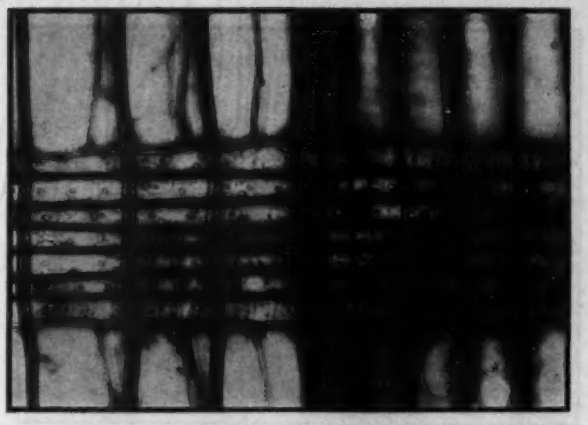


Fig. 8—Radial section of Noble fir, X-210. The absence of ray tracheids is the most distinctive microscopic feature of this wood. Compare the otherwise similarity of this photomicrograph with that of Fig. 7

Western Hemlock *Tsuga heterophylla* Sarg.

Gross features—Sapwood whitish, heartwood pinkish, light brownish white, or purplish brown; with a rather rancid or sour odor when freshly cut; hard and moderately heavy; seasonal rings of variable width; transition from spring to summerwood gradual to more or less abrupt; resin ducts normally absent.

Minute anatomy—Similar to that of *Tsuga canadensis*.

The True Firs Including:

BALSAM FIR, *Abies balsamea* Mill.
LOWLAND WHITE FIR, *Abies grandis* Lindl.
SILVER FIR, *Abies amabilis* Forb.
NOBLE FIR, *Abies nobilis* Lindl. (Fig. 8.)

Gross features. Little or no distinction between heart- and sapwood. In noble fir the heartwood is yellowish brown to reddish or pinkish in color; in the remaining species the heartwood is white to light brownish white, with lavender tones in the summerwood; soft and light in weight, relatively weak. Transition from spring to summerwood in all species more or less gradual; resin ducts normally absent.

Minute anatomy—These woods are very similar to hemlock microscopically but may usually be distinguished from hemlock by the absence of ray tracheid cells. Ray tracheids do rarely occur in the true firs, however, and their presence generally results in much confusion leading to the identification of fir wood.

Bald Cypress *Taxodium distichum* Rich.

Gross features—Sapwood yellowish to brownish yellow, heartwood brownish yellowish brown, reddish, or nearly black; very oily to the touch; frequently with a rancid odor; seasonal rings of variable width; soft to hard; light to relatively heavy; transition from spring to summerwood gradual to abrupt; resin ducts absent.

Minute anatomy—Inter-fiber pits frequently in horizontal rows 3-4 in the radial walls of springwood

Fig. 9—Radial section of Redwood, X-210. The relatively large size of the elements, the absence of ray tracheids, and the lenticular pits are all diagnostic. The irregular masses of dark material are inclusions of gummy infiltration

fibers, pits also extended to the tangential walls of the summerwood fibers. Longitudinal resin parenchyma cells relatively abundant in the springwood, the cells diffused through the fibrous tissue. Ray tracheids absent. Pits leading from ray parenchyma cells to contiguous fibers lenticular, but much smaller than those encountered in the hard pines and more distant. Ray parenchyma cells commonly partially or wholly occluded with amber colored oil or gummy material.

Redwood *Sequoia sempervirens* (Lamb.) Endl. (Fig. 9)

Gross features. Sapwood whitish, heartwood cherry red to purplish red; odorless; soft to moderately hard with a silvery lustre; often rather brash; very coarse textured; seasonal rings of nearly uniform width or somewhat variable; transition from spring to summerwood gradual to somewhat abrupt; resin canals normally absent.

Minute anatomy—Inter-fiber pits frequently in horizontal rows of 3-4 in the radial walls in the summerwood fibers. Longitudinal resin parenchyma cells abundant in both spring and summerwood, diffused or more or less zonated. Ray tracheids normally absent. Pits leading from ray parenchyma cells to contiguous fibers similar to those noted in bald cypress. Wood rays not infrequently in part 2 cells in width.

Preparation of Wood for Microscopic Study

Up to this point nothing has been written concerning the methods of preparing wood for microscopical examination. The procedure is not difficult nor is it time consuming, providing that permanent mounts are not required.

Chips from the storage bins or small blocks of wood approximately ¼ in. x ¼ in. x ½ in. in length along the grain are sufficiently large for sectioning. Care should be taken in selecting material for cutting in order that all three sections of the wood; i. e., the transverse, radial, and tangential may be obtained from the same chip or block. The pieces of wood chosen for examination should first be boiled in water until they sink thus expelling all or most of the air from them. As soon as they are sufficiently cool for handling they may be sectioned.

A sharp knife or razor blade is the only cutting edge necessary. With a little skill and practice one may cut fine free-hand sections of wood along the grain varying in thickness between 1/500 to 1/1000 of an inch. Slightly thicker sections may be made across the grain. Most of the difficulty in cutting is encountered in making transverse sections, but in coniferous woods at least, these are of the least diagnostic value, hence the lack of good cross-sections is not a serious handicap.

As the thin shavings are removed from the block, they should be placed in distilled water and stored there until needed. A watch glass makes an excellent receptacle for this purpose. On the other hand, if it is desirable to examine the sections at once they should be placed on a glass slide, flooded with water, and then covered with a slip or cover glass. The cover slip should be gently but firmly pressed down on the sections in order to squeeze out the excessive water. The light passing up through the condenser of the microscope should be materially reduced when examining thin, unstained sections of this type.

Greater optical differentiation may be had if the sections are stained before they are mounted. Any of the usual cellulosic dyes or stains will suffice for this purpose, although very excellent results have been obtained with a good grade of ordinary writing fluid. An immersion of five minutes in a bath of ink has been found very satisfactory. At the end of this period the sections should be removed and washed with water to get rid of the excess ink. All of this may be done in a watch glass with the aid of a pipette. The sections stained in this manner are mounted on slides in the usual way. If even greater optical relief is desired, a mounting medium possessing a high index of refraction, such as glycerin, may be substituted for the water on the slide.

KEY TO CONIFEROUS PULPWOODS

1. Resin canals present 2
1. Resin canals absent (traumatic canals may be occasionally in evidence) 14
    2. Spiral thickening present in both spring- and summerwood fibers; resin ducts oval in x-section; wood with a slightly offensive odor ..... Douglas Fir
    2. Spiral thickening generally absent or if present restricted to fibers of summerwood only; resin ducts circular or nearly so in the x-section; wood possessing a rather pleasant piney odor or odorless 3
3. Resin ducts plainly visible without magnification, on the x-section appearing as white dots, yellowish flecks, or as pin holes 4
3. Resin canals indistinct without magnification, on the x-section appearing as white dots, yellow flecks, or as pin holes only under a lens 11
    4. Transition from spring- to summerwood gradual 5
    4. Transition from spring- to summerwood abrupt 8
5. Rows of ray tracheids marginal and greatly interspersed, their walls dentate (toothed): pits leading from ray parenchyma cells to contiguous fibers lenticular (lens shaped); tangential walls of summerwood fibers unpitted ..... Jack Pine

5. Rows of ray tracheids marginal for the most part, their walls entire (not toothed); pits leading from ray parenchyma to contiguous fibers window-like; tangential walls of summerwood fibers sparingly pitted..... 6
6. Resin ducts appearing as white dots for the most part; seasonal rings or uneven width .....Northern White Pine
6. Resin ducts appearing as minute pin holes for the most part; seasonal rings of nearly uniform width..... 7
7. Resin ducts appearing as dark brown to black streaks along the grain; wood with a sweet sugary odor..... .....Sugar Pine
7. Resin ducts appearing as light brownish streaks along the grain or not discernible; wood with an oily to piney odor.....Western White Pine
8. Wood hard and heavy; the band of summerwood frequently constituting 50% or more of the width of the ring; orifices of resin ducts usually quite distinct without magnification .....Southern Yellow Pines
8. Wood soft or only moderately hard and relatively light in weight; the band of summerwood frequently constituting much less than 50% of the width of the ring; orifices of resin ducts visible or invisible without magnification 9
9. Wood moderately hard; oily to the touch; pits leading from ray parenchyma to contiguous fibers window-like .....Norway Pine
9. Wood soft; without oily characteristics; pits leading from ray parenchyma to contiguous fibers lenticular..10
10. Ray tracheids marginal for the most part. Wood soft; bands of summerwood very narrow; orifices of resin ducts commonly visible without magnification.....Ponderosa Pine
10. Ray tracheids marginal and greatly interspersed. Wood fairly soft; bands of summerwood variable in width, frequently quite broad; orifices of resin ducts invisible without magnification .....Jack Pine
11. Wood oily to the touch; non-lustrous; golden-brown, reddish brown; or reddish in color; longitudinal parenchyma cells occasionally present; spiral thickenings rarely present in summerwood fibers.....12
11. Wood non-oily to the touch; with a silvery or pearly lustre; white to light brown or pinkish brown in color; longitudinal parenchyma cells absent; spiral thickening never present in the summerwood fibers.....13
12. Heartwood yellow-brown to golden-brown in color; seasonal rings variable in width, the proportion of summerwood not infrequently very large.....Tamarack
12. Heartwood reddish brown to reddish in color; seasonal rings of nearly uniform width, the proportion of summerwood generally very small .....Western Larch
13. Wood white to straw-colored; with a pearly lustre; the resin ducts scarcely visible even under a 10-x hand lens; fine textured.....Red Spruce
Coarse textured.....White Spruce
.....Engelmann Spruce
13. Wood pinkish to light brown in color; the resin ducts plainly visible under a 10-x hand lens; with a pearly or silvery lustre, coarse textured.....Sitka Spruce
14. Heartwood distinctly dark reddish brown to cherry red, with a silvery lustre along the grain; some of the wood rays frequently 2 cells wide; longitudinal parenchyma abundant, the cells more or less zonate.....Redwood
14. Heartwood never dark red or cherry red in color, but ranging through white to yellow, light brownish white and not infrequently tinged with pinkish and lavender shades; wood rays one cell in width; longitudinal parenchyma present or absent.....15
15. Heartwood yellowish, brownish, or even streaked with black, characteristically oily to the touch; pits in the radial walls or springwood fibers frequently in rows of 3, rarely 4, with a rancid odor.....Bald Cypress
15. Heartwood white, light brownish white, pinkish white, or with lavender hues; smooth and dry to the touch; pits on radial walls of springwood fibres never more than 2 per row with a rancid odor or odorless.....16
16. Ray tracheids present.....17
16. Ray tracheids absent.....18
17. Heartwood very brash and splintering readily, brownish white in color but commonly tinged with lavender; with a sour or rancid odor when wet....Eastern Hemlock
17. Heartwood fairly firm and tough but splintering readily, pinkish to golden brown in color; with a slightly rancid or vinegary odor when wet.....Western Hemlock
18. Heartwood yellowish to brownish red or pinkish, hard and moderately heavy.....Noble Fir
18. Heartwood brownish white, with an occasional purplish tinge, soft and light in weight..... .....Balsam Fir
.....Lowland White Fir
.....Silver Fir

◆ ◆ ◆

The First Papermaker

THERE are numerous published references to the invention of paper. Many historical presentations credit the invention to T'sai-Lun, a Chinese scholar who lived during the early days of the Christian era. These references state that he succeeded, in or about the year 105 A.D., while in the service of his emperor, to make paper from several raw materials, among which bark, tow, old linen and fishnets are commonly mentioned.

T'sai-Lun's invention, however, had been antedated by the lowly wasp, although it was left to Reaumur, the great French physicist and naturalist, over 1600 years later to observe and record this work.

Reaumur, in studying the habits of the wasp, noticed that the wood material used by these insects in the construction of their nests resembled paper. This fact was presented in a treatise to the French Royal Society in November, 1719, by Reaumur who further suggested the possible use of wood as a papermaking material. He commented upon ways and means of treating the fibers made by American wasps to permit their use in the production of a fine sheet of paper, and likened the nest covering of the Canadian wasp to that of somewhat aged white paper of fine quality and as heavy as that used in ordinary portfolios.

Although the material fabricated by wasps in the construction of their nests is hardly comparable to modern high grade papers, it is extremely interesting to observe the professional way in which this insect produces it. In the first place, the raw material is chosen with meticulous care, the wasp seeking out such dry wood as that of weather-beaten boards and fence rails to work upon. After a source of supply has been made available, it is reduced to pulp by rasping or sawing and by mastication. The wasp, following the production of the pulp, then sizes it with a material exuded from its own body, works it to the desired point, and spreads it out into the nest covering.

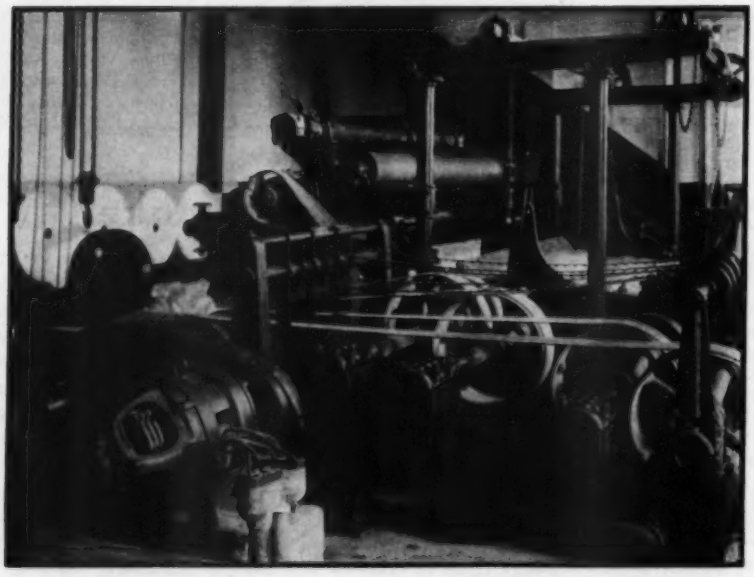
In the small body of the wasp, therefore, is housed a complete pulp and paper mill with its integrated power plant which has probably been operating since the beginning of time.

Does not the title of the first papermaker and perhaps the first builder of a paper house rightly belong to the wasp?

Modern Winder Drives

Improve Operation and Reduce Roll Costs

By N. L. DANFORTH[1] and R. R. STOLTZ[2]



Modern 4-drum winder drive of 20 years ago — chain driven by an a.c. wound rotor induction motor

OUT of every dollar spent on power in the operation of obsolete winder drives, more than half frequently goes to heat up and wear out brake bands and drums on the unwinding stands. This loss of power can be eliminated and total power costs on the winder drive reduced with the modern direct current variable voltage winder drive with regenerative braking and automatic tension control.

This innovation for driving paper machine winders employs the use of an electric braking generator that returns energy, formerly wasted, to the winder motors. Furthermore, it provides automatic control of sheet tension, the most important requisite of a properly wound roll of paper. This modern drive with individual motors on each drive shaft and a braking generator on the unwinding stand can be applied to all types of winders.

Roll Winding Difficulties and Requisites

With production speeds of paper machines well over 1,000 feet per minute, it becomes extremely difficult to properly wind and prepare the finished roll of paper for shipment, and for use on the modern high speed presses. This high speed production has resulted in extremely high winding speeds—3,000 feet per minute or more. Little time, therefore, can be lost for setting-up and making good splices, nor can the operator's senses of touch and sight alone be depended upon for producing properly wound rolls of paper.

Two of the most important requisites of properly wound rolls are:

(a) That they be wound with uniform density and tension from the core to the outside to insure against uneven strain and damage in shipping or handling.

(b) That they be free from wrinkles, creases, welts or irregularities in the surface of the sheet.

These two physical characteristics of well-wound rolls are largely dependent upon the accuracy with wich the tension of the sheet is controlled between the unwinding stand and the winder.

The rigid requirements imposed upon auxiliary winding equipment were realized in the installation of two 228-inch high speed news machines at the Maine Seaboard Paper Co. These machines, designed to operate from 500 to 1,500 feet per minute, were served with a 3,000-ft. per minute paper speed two-drum winder. After careful consideration, it was decided to equip each of the winders with the Westinghouse direct current variable voltage electric drive with regenerative braking and automatic tension control.

Due to the high operating speed of the winders, it was possible to apply direct coupled motors to the winding rolls, thus eliminating all gearing and the adjustable speed device between the front and back roll.

Each winder drive receives its power from a separate induction type motor-generator set with an adjustable voltage d.c. generator of suitable capacity.

The control for these drives in each case includes: a manual across-the-line type starter for the motor-generator set; a drum type master switch and speed control rheostat; and a simple form of magnetic control with dynamic braking and arranged for cabinet mounting, for the direct current motor equipment.

Winder Operation Described

The operation of this winder drive briefly is as follows: The induction motor-generator set is first started, and after being started, remains in continuous operation during the normal operating period of the winder. Excitation which is obtained from the sectional paper machine drives is always available, and is supplied at constant voltage.

The drum type master switch and speed control rheostat is provided for starting the winder and adjusting its speed. This drum controller, which is hand operated and located convenient to the operator, serves to adjust the volt-

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[2]Industrial Department, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

age of the main d.c. generator. When the winder motors are not in operation, the main d.c. generator operates at a very low voltage, and when the drum controller is moved to the first point, the motor equipment is connected to the main generator with this generator operating at the low initial voltage. In this manner, the winder may be started very smoothly and accelerated to a slow operating speed suitable for threading-in the paper.

To increase the speed of the winder, the drum controller is moved forward. This drum is built with a total of 60 operating points, thus permitting a very fine adjustment of the operating speed between threading-in and maximum operating speed. There is no sudden transition from the threading-speed to the minimum operating speed, and the acceleration of the winder can be accomplished at a moderate and uniform rate that eliminates any tendency to tear the sheet between the unwinding stand and winder during this operation. The speed of the winder is reduced by moving the drum controller in the reverse direction.

The winder may be stopped by returning the drum controller to the "off" position, or by depressing the "stop" pushbutton. Either operation serves to disconnect the motor equipment from the main d.c. generator. On such high speed winders quick stopping is desirable, hence, dynamic braking was specified. Braking resistance is automatically inserted in the winder motor armatures after they have been disconnected from the main generator. This form of braking permits a rapid deceleration without excessive current peaks on the motors and main generator, thus preventing damage to the commutators of these machines. After the winder has been stopped by the "stop" button, it is necessary to return the drum controller to the "off" position before the winder can again be started. This procedure assures that the winder always starts smoothly with minimum voltage applied to the motor armatures.

Each motor of this multiple motor winder drive is provided with a hand operated field rheostat which permits adjusting the relative torque or turning effort developed by these motors so that the proper tightness of wrap may be secured. After such an adjustment has been made, it is automatically maintained from the empty winding core to the full roll by the inherent characteristics of the motors.

The braking generator drive is coupled direct to the unwinding stand, and is electrically connected in series with the main d.c. generator. The energy, therefore, which ordinarily is wasted in the mechanical brake, is returned through the electrical equipment and assists in driving the winder.

The auxiliary control supplied with the braking generator automatically maintains constant tension between the unwinding stand and the winder by means of a simple type of regulator. This regulator functions to maintain constant power output from the braking generator at any particular operating speed, thus resulting in constant tension of the sheet. A manually operated rheostat with suitable meter equipment is provided so that this tension may be accurately and easily adjusted. After the tension has been adjusted it is automatically maintained from minimum to maximum operating speed throughout the complete winding operation. The tension control rheostat as well as the drum type master switch and speed control rheostat with an emergency "stop" button are all centralized at one point.

Advantages of Drive Set-Up

These winder drives provide the following features:

1—Reduced power cost through elimination of mechanical brakes on the unwinding stands. In other words, the power formerly consumed in heating up and wearing out these brake bands is now restored to the system.

2—Increased production through convenience and simplicity of operation of the winder from a central point.

3—Reduced maintenance by elimination of mechanical brakes, gearing, belting or other mechanical parts.

4—Smooth acceleration and deceleration which prohibits any sudden transition from the threading-in speed to the minimum operating speed, which prevents paper breaks, and which also makes it possible to properly wind the roll of paper without irregularities in the sheet.

5—A low and satisfactory threading speed which is also essential to good winding and minimizes the time lost in setting-up making splices, etc.

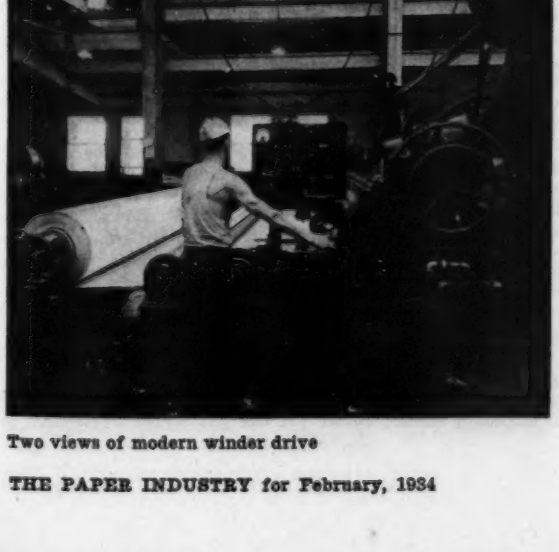
6—Dynamic braking for rapid deceleration, affording full protection to the motor and generator equipment.

7—Accurate and automatic tension control eliminating all personal supervision, thus making it possible to wind a perfect roll of paper.

8—Saving in floor space through elimination of all gearing, belting, mechanical speed devices and other mechanical parts. This feature also reduces personal hazards affording the operators a clean free space with which to perform their work.

9—Complete metering indicating at all times the correct tension and loads on the various machines, which eliminates guess work from the winding operation and which also prevents shutdowns of long duration.

After three years of operation these two winder drives have proved to be a complete success and have more than lived up to all expectations. In short, these drives have made it possible to wind a better roll of paper, at a lower cost.



D. C. motor for each under roll in background; D. C. breaking generative drive coupled to unwinding stand in foreground

Close-up of centralized control

Two views of modern winder drive

Canadian Technical Section

Holds Twenty-First Annual Meeting

THE twenty-first annual meeting held in Montreal on January 24, 25 and 26, was undoubtedly one of the most profitable and successful ever held by the Technical Section of the Canadian Pulp and Paper Association. As in the past two or three years, the sessions were held in the hall of the Engineering Institute of Canada, the smaller hall at the Pulp and Paper Research Institute being taken up by the meetings of the Woodlands Section; and the attendance at the Technical sessions filled the hall practically to capacity.

Following established precedent, the first session was opened by the address of Harold Crabtree, president of the parent association, who remarked that this was the fourth consecutive year that he was privileged to open the deliberations of the pulp and paper technicians. His brief message dealt with but two points. Speaking of the proposal to create a new class of membership, to be known as "affiliated members," he warned against opening the doors of the Section to outsiders merely as a method of obtaining funds to help balance the budget. If this were the main object of the proposed amendment to the constitution, other means should be taken to obtain the money required, and for his part he would be only too willing to do everything in his power to this end. On the other hand, if proper care was taken that requirements for new membership would admit only desirable members who would be in full sympathy with the aims and ideals of the Section, it was a step in the right direction.

The second point of the President's address referred to the work carried out at the Research Institute. Elimination of research in times when stringent economy was imperative, was "penny-wise and pound-foolish." It could be said to the credit of the association that it had continued its grant to the work of the Institute in spite of the fact that its income had been cut in half. An admirable spirit was displayed by all the workers at the Institute, who, in spite of reduced appropriations, were displaying a most remarkable activity. The results of their work were bearing fruit that vindicated the ideal of the men of courage and vision who, some eight or ten years ago, advocated uniting the resources of the Government, the University and the Association. The encouragement and assistance of the Technical Section was essential to the Institute in order that it might obtain results of direct financial value to the industry.

Chairman F. L. Mitchell's report reviewed the chief features of the past year's activities in the Section and drew attention to the potential development of a news print industry in the Southern States. This matter, he said, was of vital importance to the members individually and to the Canadian news print industry as a whole because, as technical men, they realized only too well the possibilities of the success of the able research which is being so actively conducted under the direction of Dr. Herty. This potentiality constituted a challenge to all technical men, operators and executives in our industry, which must be met if our Canadian news print industry was to continue to maintain its fully competitive position in the world's market for this commodity.

The members were then called upon to vote upon the two proposed amendments to the Constitution. The first provided for the creation of a new class of membership, to be known as Affiliated Members, to which would be eligible companies or organizations which did not engage directly in the manufacture of pulp or paper, but which were closely affiliated with the industry. C. B. Thorne, of Canadian International Paper, expressed misgivings that this would open the doors to many salesmen, would lower the very high professional standing at present enjoyed by the Technical Section and might seriously interfere with the proper functioning of the Section as pulp and paper technicians. Members of the Executive Council explained that the amendment had been very carefully worded with a view to guarding against this very danger; every application for this class of membership would be passed upon by the Council, which could turn down any one who, in its opinion, did not measure up to the high standard of requirements already established for membership in the Section. The views of the Executive Council prevailed and the amendment was carried by a large majority. The second amendment provided for the election, from among the members of the council, of a vice-chairman to shoulder a part of the ever-growing task at present borne by the chairman. It was adopted without a formal vote being taken.

Contrary to the custom of former years, the committee reports were not read and discussed, with the one exception of that of the Committee on Physical and Chemical Standards. This report definitely recommended official adoption by the Section of the British Pulp Evaluation Apparatus and the method of its use as given in the Interim Report of the Pulp Evaluation Committee to the Technical Section of the Papermakers' Association of Great Britain and Ireland (October, 1929). The committee also emphasized the importance of having one set of units (preferable the metric system) for expressing test results, and made several suggestions with a view to initiating steps to this end.

Research Activities Outlined

The adoption of this report was followed by three important papers in which Dr. Harold Hibbert, Dr. O. Maas and Dr. J. H. Ross described in turn the research progress effected in the Department of Industrial and Cellulose Chemistry at McGill University, the Department of Physical and Electro-Chemistry at McGill, and the Pulp and Paper Division of the Forest Products Laboratories of Canada. At the conclusion of the last of these three papers Dr. E. Heuser congratulated the three speakers on the truly remarkable wealth of results obtained to date; he complained, however, that really too much food for thought and discussion had been given to the meeting all at once. It was time to adjourn, and yet material had just been placed before them that could profitably be discussed for a whole day.

For some time past, a feeling had been growing in both the Technical and Woodlands Sections that closer co-operation was necessary between these two groups of men. Owing to incomplete knowledge, and even complete ignorance, by technical men of the problems of the woodsmen, and vice versa, neither could render maximum service to their respective employers and to the industry as a whole. With a view to bridging this gap, the two Sections sat down to lunch together on January 24, after which Howard Kennedy and F. L. Mitchell, chairmen of the respective sections, presented papers discussing at length the Marginal Problems Between Mills and Woodlands and bringing out in a very striking manner the advantages to be derived by all concerned from a better appreciation of each other's problems. The comments of such outstanding men in the industry as D. L. McLeod, J. D. Gilmour, Elwood Wilson, E. A. Charlton, T. A. McElhanney, A. M. Koroleff and John Stadler, unanimously endorsed the stand of the speakers, and showed that the step taken by the two Sections met with the approval of all concerned.

Discuss Forced Circulation in Sulphite Cooking

The afternoon session was devoted entirely to a symposium on Forced Circulation in Sulphite Cooking, under the direction of Vance P. Edwardes. The proponents of three different systems were called upon to explain the merits of their respective methods. G. L. M. Hellstrom, of Paper Machinery, Ltd., advocated the use of downward circulation in the digester without any screen at the intake pipe. According to his theory, the digester could be compared to a huge cooler for the hot liquor introduced at the top, and he claimed that with down-

ward circulation inside the digester there was much less danger of channelling and formation of cross currents. For some reason that had not yet been definitely established, possibly arching of the chips near the bottom of the digester, the liquor withdrawn from the bottom of the digester carried very few chips; and such chips as were entrained were prevented from causing any trouble by using a trash type of pump which could readily handle them without blocking. A. D. Merrill, of Chemipulp Process, Inc., reviewed briefly the history of positive circulating systems in sulphite cooking as given in United States patents. Such systems were advocated as far back as 50 years ago, but apparently stress was laid only upon the importance of uniform temperature distribution. It was T. L. Dunbar who, in his United States patent No. 1,669,234, of May 8, 1928, who first appreciated the importance of uniform distribution of acid concentration and recommended reincorporating into the circulating liquor the gas which separates in the top of the digester. He brought out the advantages of hot-acid circulation according to the Chemipulp system prior to steaming, and combining this with the Lurgi system during the steaming period. Mr. McAllister, of the Babcock & Wilcox Co., dealt with the merits of the system developed at the Kimberly-Clark mills, which makes possible a completely automatic control of the sulphite cooking process. Contrary to Mr. Hellstrom, he emphatically favored upwards circulation inside the digester, which he considered to be the most rational procedure. The three papers gave rise to a most spirited discussion. Unfortunately certain operating data which were to have been presented, could not be procured in time, but will probably appear in the printed papers. The discussion, however, brought out very strikingly the present lack of reliable means of determining pulp yields simply and accurately; and without reliable pulp yields it is very difficult to satisfactorily estimate the actual benefits derived from a given system.

Why Do Sulphite Papers Curl?

On Thursday morning, W. A. Ketchen, of Fraser Papers, Ltd., gave a most interesting and instructive account of his experience in the mill with Curl in Sulphite Papers, explaining various troubles encountered, the means taken to remedy them and the success which had attended these efforts. According to Mr. Ketchen, curling was essentially due to two-sidedness of the sheet with respect to moisture content, and the trouble could be very largely eliminated by adjusting conditions so that both sides of the sheet had the same moisture content when it left the paper machine, and also when it was used, either by the printer or by the converter. Dr. Hoover, of Provincial Paper, stated that his experience with a fairly old machine, making various types of paper over a wide range of weights, on the whole bore out the findings given in Mr. Ketchen's Paper; but he considered that curl was fundamentally a matter of physical two-sidedness of the sheet, but not necessarily only of two-sidedness in moisture content. According to Dr. Hibbert, the fundamental aspect of the problem goes back considerably further and is probably related to the attachment or adsorption of water to the paper surface through the presence of hydroxyl groups in the cellulose molecule; and, reasoning from purely theoretical considerations, he suggested that at no stage in the manufacturing process should the moisture content be allowed to fall below about 6%, as, with a lower value, there was danger of an irreversible gel being formed on the surface of the paper. In line with Dr. Hibbert's remarks, Mr. Pounsford, of Provincial Paper, stated he had had occasion to observe that paper made from very dry wood had more curl than that made from green wood, and suggested this may have been due to differences produced in the fibers by drying beyond a certain limiting value.

Low-Sulphite News Machine Design

In the following paper, E. M. Little, of Anglo-Canadian Pulp and Paper Mills, put forth some of his ideas regarding Some Possible Developments in Machine Design for Low Sulphite News Furnishes at High Speeds, in which he stressed the importance of improving wire drainage conditions. This paper elicited one of the best discussions ever heard at any of the Technical Section meetings and showed that there was quite a diversity of opinions. The Forest Products Laboratory at Madison has recently started a study of paper machine variables, and it was suggested that any investigation started up along these lines in Canada could advantageously be linked up with the work being done at Madison. Some of the statements made indicated that a good deal more factors should be taken into consideration than Mr. Little had mentioned. John Stadler, for example, stated that as far back as 20 years ago he had made news with only 6 per cent sulphite, and he had encountered no end of difficulty owing to lack of elasticity of the sheet. The first factor to be considered in the production of low-sulphite news was press room requirements; and the loss of elasticity produced by reduction of the sulphite content would have to be compensated in some other way. Low sulphite required attention, not only at the wire, but along the whole machine, including air conditioning; the necessary changes, either in design or operating conditions of the machine, constituted but a portion of the problem, and probably the one most easily solved. The most difficult part lay in obtaining the required sheet quality.

Research Director Speaks at Luncheon

The guest speaker at the luncheon was Dr. Horace B. Speakman, director of the Ontario Research Foundation, who dealt with Vision and Research in Industry. He outlined the manner in which the Ontario Research Foundation had been established and gave several examples of results of value to various industries which had already been obtained. In concluding he paid tribute to the Canadian Pulp & Paper Association, the Dominion Government and McGill University who had established an exceptionally successful tripartite co-operative research organization, which already was obtaining results of great scientific and industrial value and held limitless promise for the future.

Southern News Print

During the afternoon, the Section heard from L. C. Anderson, of Beaver Fibre Co., a Report by an Observer on the Recent Experimental Run of News Print from Southern Pine, while A. A. MacDiarmid, of Price Bros., discussed Southern Pine News Print Competition from the standpoint of the Canadian industry. Mr. Anderson, who was priviledged to witness the commercial conversion into news print of several tons of Southern pine sulphite and groundwood, which was carried out a few months ago on one of the paper machines at the Thorold plant of the Beaver Fibre Co., stated that this run proved conclusively that news print could be manufactured commercially from Southern pines. The quality of the paper turned out at the Thorold mill certainly did not measure up to the quality of standard Canadian news; but it should not be forgotten that the pulps had been produced on units of experimental size and that there had as yet been no opportunity of correcting pulp quality by observing the paper made therefrom. John Stadler warned against depending too much upon the superior quality of news print made from Northern spruce; the investigation of Southern pine news print was in the hands of a group of very aggressive and capable technicians, and even at the present time there were mills in the United States making fine papers and rayon pulp from Southern pines. Mr. Anderson presented and discussed an itemized estimate, prepared in Dr. Herty's laboratory, of the cost of production of news in the Southern States. Though a few of the items, in Mr. Anderson's opinion, might require a slight upward or downward revision, the total estimated cost was probably not very far out, and was very much below what any of the northern mills could hope to arrive at.

Groundwood at High Speeds

Dr. H. Wyatt Johnston described work which had been carried out very recently at the Research Institute in the course of a Laboratory Investigation into the Effect of Grinder Speed on Groundwood Carried into the Realm of High Speeds. While the work was admittedly of a preliminary nature, and did not permit of drawing any definite conclusions, it certainly showed some most interesting trends, which, however, will require a much more extensive investigation before they can be taken as definitely proven. A three-pocket grinder was used, having a stone with a 15-inch face

and driven by a 275-horsepower motor which could be driven at eight different speeds. Speeds up to 5,500 feet per minute were used with an artificial stone, and of up to about 4,600 feet with a sandstone. The results obtained indicated stone output increased approximately linearly with increase in either stone-surface speed or grinding pressure; but these two factors had opposite effects on pulp quality: increasing the pressure increased the freeness and reduced the bursting test, while increasing the speed reduced the freeness and increased the bursting test.

Analysis of Power Consumption in Grinding

In the last paper on the agenda, Dr. W. Boyd Campbell attempted a Theoretical Analysis of Power Consumed in Grinding. While admitting that some of the values used in his calculations could not be taken as very accurate, he considered that his estimations were of value in showing the order of magnitude of the efficiency of the wood grinder. He arrived at the conclusion that the amount of useful work done in grinding the wood was only about, 0.012 per cent of the total energy consumed by the machine, and added that this figure was probably on the high side. This certainly gives plenty of food for thought and affords a wide field for investigating a more efficient utilization of the power expended in grinding wood.

Officers for 1934

F. L. Mitchell, of Provincial Paper, was re-elected Chairman of the Section for 1934; H. J. Rowley of Anglo-Canadian Pulp and Paper Mills, and L. C. Anderson, of Beaver Fibre Co., were elected Councillors in place of D. W. Ambridge and B. D. Millidge, whose terms had expired. D. L. McLeod, E. A. Charlton and John Patterson, the Section's representatives on the Joint Administrative Committee of the Pulp and Paper Research Institute, were re-appointed for the present year.

On account of the desire expressed by Dr. Heuser and a number of other members to have an opportunity to discuss the papers presented at the Wednesday morning session by Drs. Maas, Hibbert and Ross, arrangements were made for a special session on Friday morning. This took the form of an informal talk by each of speakers in turn, who described in greater detail than could be done in a formal paper the development of one of the several researches which he directed. Dr. Maas dealt with the investigation of consistency and particle size by means of light absorption using an opacimeter of his own design; he also spoke of his investigations into physical and chemical factors which influence sulphite cooking. Dr. Hibbert dealt with the importance and possible applications of recent developments on the constitution of cellulose, more particularly as regards attachment of water to the surface hydroxyl-groups of the cellulose molecule. Dr. Ross described his investigations into the possibility of producing kraft or soda pulp of a quality suitable for rayon manufacture. Each of the speakers was called upon to answer numerous questions put by the approximately sixty members who had gathered to hear them. The great interest manifested by such a large number of members will in all likelihood result in extending the annual Technical Section meeting to two and a-half or three days in future years.

J. B. White Made President of Parent Ass'n

At the annual meeting of the parent association, Brigadier-General J. B. White, D. S. O., vice-president of Canadian International Paper Co., was elected president, succeeding Mr. Harold Crabtree. In recognition of the value of the work of the Research Institute and on account of the necessity of obtaining knowledge of the fundamental factors governing the manufacture of groundwood, the Association decided to increase the assessment on news print to the extent of one cent per ton, the increased assessment to be devoted to research.

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◆ Monthly Inspection

Properly conducted periodical inspections of the character about to be described are advisable for reasons of safety, economy of operation, and proper control of maintenance costs. In this connection it might be stated that too much reliance ought not to be made upon the yearly inspection, that is, each periodical inspection should be complete in itself.

Each boiler should be withdrawn from service at least once each month for inspection. Local conditions may make it necessary to perform this inspection more frequently. In extreme cases it may be necessary to clean them as often as once a week. Frequency however, can be decided upon only by the conditions prevailing in each individual case. It has sometimes been found advisable to clean more frequently in dry seasons than in wet seasons, due to the fact that at such times the water can carry more foreign matter.

In cooling down, close valve between boiler and steam header; close the feed valve and draw the fire. When pressure has dropped to 10 lb. or less, open the blowoff and empty the boiler. Remove all soot and ashes possible and allow the brick work to cool. Then remove the manhole cover; it is a good plan to scratch cover and manhole seats in such a manner as to make it possible to put the cover back in the same position. This often saves the cutting of a new gasket.

Careful record should be kept of every inspection made. As soon as the boiler and brick work are well cooled down boilers should be thoroughly washed out. A large part of the loose sediment may be removed by washing by means of a hose throwing a strong stream of water which should be directed against all parts of the boiler from every direction possible. If sufficient time cannot be allowed for the boiler to cool, hot water should then be used for washing.

The inside of the boiler should be examined for scale. Is there any? Is it hard or soft, loose or adhering? Where accumulated and where in greatest amount? Examine carefully, also, for pitting and corrosion, especially near the water level, although this may occur anywhere inside the boiler. Examine also for oil. If any tubes appear to be in a dangerous condition, they should be replaced at once. It may save time to remember that, in water-tube boilers, "if there is no scale in the lower row of tubes there is probably none in the rest." Do not fail to give careful attention to the feed water lines at the entrance to the boiler. Unless properly treated, these are usually found to contain a great deal of scale, sometimes in sufficent quantity to interfere seriously with the flow. The piping to the water column should also be examined to make certain that the openings are not clogged.

In the boilers having stays, it is necessary to test for tightness of stay rivets. In particular, examine the stays for looseness, as it is likely that a loose stay is not carrying its share of the load. To test a rivet for tightness, place thumb or finger of left hand so as to rest against rivet head and surface around it. Hit rivet with hammer. Any relative motion of rivet and plate will be felt.

In examining the exterior of the boiler, give particular attention to the tubes, especially those in locations where soot and dust collect and at which corrosion may take place. Such corrosion is often caused by water which leaks from the boiler and mingles with this dust, and can only be prevented by preventing the leakage.

Particular attention should be given to the blowoff connections and piping to make sure that no rapid deterioration is taking place in the metal. In those cases in which the blowoff pipe is protected from the fire by special covering or brick work, such covering or brick work should be examined for cracks or crimbling away. The presence of mud deposit in the mud drum indicates that it is not blown out often enough.

◆ Heveatex Corporation Opens New York Office

In order to more promptly handle inquiries from Eastern fields for its products, the Heveatex Corporation of Melrose, Mass., have opened an office at 90 Broad Street, New York City, for sale of rubber latex and concentrated latex and for technical servicing of these products.

The New York office will be in charge of W. J. R. Hauser who has just joined the corporation as Vice-President in charge of sales. Mr. Hauser is well-known in connection with his work of some years in the United States and abroad in the development of the uses of latex and concentrated latex in the paper field, and his extended experience will be available to users and experimenters for applications of latex in the paper field.

◆ Largest Paper Machine to Have Cameron Winder

The Cameron Machine Company, Brooklyn, N. Y., announces that the world's largest paper machine which is now being built for the Kemsley, Kent plant of Edward Lloyd, Ltd., English paper manufacturers, will be equipped with a new type 20 high speed Cameron Winder. This winder is now under construction at the Canadian plant of the Cameron Machine Company.

This largest paper machine will have a wire width of 320 inches and will operate at 1400 f.p.m.

◆ Three-Quarter Million Acres for Forests

The National Forest Reservation Commission has approved a purchase program totaling 776,378 acres for National forest purposes. This acreage, scattered over 20 States, constitutes one of the largest additions to the National forest total east of the Great Plains in recent years. The purchase brings forest land acquisition in the East since last spring up to almost two and three-quarter million acres, completing about a third of the program for which President Roosevelt in June allotted $20,000,000 of Emergency Conservation Work funds.

Most of the new purchases lie in the Southern Pine and the Lake States forest regions, within the gross boundaries of existing national forest and national forest purchase units. The average price to be paid for the land is $2.57 per acre and the total expenditure approved is $1,994,011. Prices ranged from $1.26 to $8.79 per acre, the lower prices prevailing in cutover and denuded lands in Southern and Lake States, and the higher prices in well-timbered tracts in the Green Mountains and the White Mountains in New England.

The lands to be purchased will be placed under administration and protection of the United States Forest Service. Improvement work by the Civilian Conservation Corps will immediately extend to many of the tracts.

Purchases approved in Mississippi amount to 163,947 acres, in Michigan to 162,447, in South Carolina to more than 64,000 acres, and in Missouri and Wisconsin more than 50,000 acres each. Grouped by forest regions, the purchases aggregate 12,988 acres in New England; 59,275 in the Appalachian; 247,399 in the Southern Pine; 99,569 in the Ozark and Central Mississippi River; and 256,114 in the Lake States region.

The Commission also ratified a recess approval, as part of the three-quarter million acre total, for the purchase of about 100,000 acres, in the Hiawatha National Forest in Michigan and the Superior National Forest in Minnesota, and 1,264 acres for the McNeil Experimental Forest in Mississippi. Some minor modifications of boundaries were made for the Ozark National Forest in Arkansas and the Pisgah National Forest in North Carolina. Watershed value reports were received on national forest unit lands in Alabama, Arkansas, Mississippi, Virginia and West Virginia.

◆ Repairing Cracks and Holes in Paper Mill Floors

Every once in a while the problem of repairing concrete floors comes up for handling. The question is asked, "What can be done with a bad crack that leaks water? How can a repair be made that will be both substantial and waterproof?"

Unless there is considerable vibration on the floor, it is a simple matter to waterproof it. First, cut out the crack into a V-shaped groove to a depth of at least 2 inches. Then sweep water over the newly cut concrete to remove all loose particles of cement and sand. Next, prepare a stiff, waterproof mortar by mixing together 1 part portland cement and 8 parts of clean, sharp sand, and wet down with a solution of 1 part liquid waterproofing and 8 parts of water. Immediately before filling the grooves with this new mortar, brush over the clean, damp surfaces a slush or bonding coat made by stirring into a solution of 1 part liquid waterproofing and 3 parts water, enough portland cement to form a thick, creamy cold water paint. While this cement wash is still damp, apply the new mortar and trowel it to a smooth finish.

In a similar way, ruts and holes in a concrete floor can be cut out to a depth of 1½ inches below the finished floor and new patches applied. These patches will adhere to the underlying concrete and will be waterproof, hard and dustproof. Patches of this type harden over night so that repairs can be made on Saturday afternoon and Sunday or during a similar shut-down.

◆ A. G. PRATT, president of the Babcock & Wilcox Co., has been elected to the board of directors of the Worthington and Machinery Corp., Harrison, New Jersey.

◆ Falk Grants License to J. D. Christian

Announcement is made of the licensing by the Falk Corporation of Milwaukee, of J. D. Christian Engineers, for the manufacture of Rite-Lo-Speed Motors under the original Christian design. The Falk Corporation is the new owner of U. S. patent No. 1,860,703 originally issued to J. D. Christian.

The standard motor units known as Series HD manufactured by the Christian organization are produced under pending patent applications owned by J. D. Christian.

◆ CHARLES H. BAUER has been engaged as merchandising manager of the V-Belt department of The Manhattan Rubber Mfg. Div., Passaic, N. J. Mr. Bauer is well acquainted with distributors throughout the United States, Canada and Mexico.

◆ Simplification and Commercial Standards Work Continued

The Department of Commerce announces that it has been decided to continue the simplification and commercial standards work at the Bureau of Standards, in cooperation with the American Standards Association and other organizations and groups concerned with such work. The work has an added importance at this time because of the need for reference to standards of dimensions and quality in the N.R.A. codes for fair competition.

In order to provide maximum benefits for the ultimate consumer, the Bureau, in accepting simplified practice projects, will give priority to those in which the producer groups will signify, in advance their willingness to identify simplified items in their catalogues and other trade literature.

Similarly, in accepting commercial standards projects, the Bureau will give priority to those in which the producer groups will indicate, in advance, their willingness to employ labels on the product, constituting binding guarantees of compliance with the standards set up in order that the maximum service may be rendered to the consumer in over the counter trade.

◆ John Owen Joins Fox River Paper Co.

John Owen, formerly with the Fraser Industries, has joined the sales staff of the New York Office of Fox River Paper Company, 350 Madison Avenue, New York City.

Mr. Owen gained his knowledge of this field through many years of association with the American Writing Paper Company, Inc. He assumed his new duties at the beginning of the year.

◆ SKF INDUSTRIES, Inc., announces the removal of its general and executive offices from 40 E. 34th St., New York City, to Front Street and Erie Avenue, Philadelphia, Pa. This effects a consolidation of the company's manufacturing, sales and engineering facilities.

◆ ST. LOUIS distributors and dealers are selling coke in paper sacks which are charged into the heater or furnace without opening. The individual bags weigh from 15 to 20 pounds.

◆ American Cyanamid Leases New Offices

American Cyanamid Company, New York, announces that it has leased from Rockefeller Center, Incorporated, about 120,000 square feet on the 57th, 58th, 59th, 60th and a part of the 61st floor in the new R. C. A. Building at 30 Rockefeller Plaza, New York. The lease is for a term of twenty years.

The move was necessitated by the need for more space by American Cyanamid to take care of its growing business and to provide for future expansion. As the company occupied at its present address about 25 floors each having much less space, the new location, being all on five adjoining floors, will lend itself to much more efficient conduct of the company's business.

The American Cyanamid Company and its subsidiaries will move to the new location about April 1st.

Miniature Paper-Making Machine Built by Rice, Barton & Fales, Inc.

This miniature papermaking machine was manufactured by Rice, Barton & Fales, Inc., for The Franklin Institute Philadelphia. It is a complete scale working paper-making unit that will actually produce various kinds of paper 8-½ inches wide.

The entire assembly, mounted on a table 18 ft. long, 4-½ ft. wide and 3-½ ft. high, consists of a ¾-pound beater, two copper beater chests with agitators, motor driven stuff pump, copper machine chest with agitator, flat plate diaphragm screen, motor driven vacuum pump, motor for constant speed parts, motor for variable speed parts, and complete fourdrinier paper machine.

The fourdrinier part has a wire 11 inches wide, 68 inches long, with copper-lined flow box, shake arrangement, slice deckle attachment, dandy roll, couch rolls and three suction boxes. Two main presses with rubber covered bottom rolls and brass top rolls. Felts each 46 inches long. Eight dryers complete with felt equipment for one top and one bottom felt. Dryers heated electrically with thermostatic control. One six-roll stack of calenders and a single bar reel.

Each unit is driven by a worm gear reduction unit running in oil, and cone pulleys. Line shafting for constant and variable parts is carried on SKF drop hangers.

Complete system of brass pipes is provided for fresh water, drains and stock. This unit is wired completely in conduits with a panel on which are mounted the control units and safety switches.

◆ New G-E Oil-Immersed Explosion-Proof Switch

A new oil-immersed, combination switch, designated as CR7008, has been announced by the General Electric Company for use in Class I, Group D, hazardous gas locations.

The switch is available in three sizes for motors up to 50 hp. at 440-volts, and consists essentially of three parts: a magnetic switch, a motor circuit switch, and a thermal, overload relay which is reset by a plunger extending through the top cover. These parts, together with all connections, are located six inches below the surface of the oil in an oil-filled tank of welded construction. The tank, which is welded from heavy sheet steel, is supported from the top cover by four wing bolts. Handles on the sides of the tank facilitate its removal.

The top cover of the tank is a heavy iron casting and is provided with three threaded conduit entrances for the line, motor, and control connections. The cover also has lugs so that the switch may be wall-mounted.

◆ Dielectric Strength Test Set

An instrument for testing the dielectric strength (insulating value) of sheet material such as paper, gummed paper, varnished cambric and paper, and other insulating materials is being manufactured by Sound Engineering Corporation, 416 Leavitt Street, Chicago. The unit, completely self-contained in a strong all-metal box, is designed to operate on a 110-volt, 60-cycle circuit or 220-volt circuit if required.

◆ Coe Drainator

The Coe Drainator, an improved design of the original Chevalier Drainator developed in San Francisco, is a simple, compact apparatus for the removal of steam condensate from steam condensing devices, process equipment, etc. It has no moving parts and relies for its operation upon the utilization of the thermo-dynamic properties of steam and hot water to regulate the flow.

This device, made in various sizes from ½ inch to 1½ inches and designed

to operate on any steam pressure up to the mechanical strength of its body without any exchange of parts, is claimed not to require a by-pass. Design features also include a positive,

visual indication that the condensate is being eliminated, as well as means for handling entrained air.

An illustrated bulletin of the Drainator will be sent on request to any one addressing The Coe Manufacturing Company, Painesville, Ohio.

◆ Product for Feed Water Treatment

A highly concentrated semi-solid organic product for feed and hot water treatments, known as H-O-H series D formulae, has been developed by D. W. Haering & Company, Inc., Chicago.

This product is adjustable to meet varying water conditions and is supplied in adjusted form following water analysis by the manufacturer's laboratories. It is available in several forms including sodium phospho glucosate and sodium ferro glucosate formulae. These formulae are said to combine directly with oxygen to form stable compounds and to form colloidal gels with calcium and magnesium.

◆ Stationary Metal Cutting Machine

The Linde Air Products Company, 30 East 42nd Street, New York, has introduced a new stationary cutting machine which is known as the Pantosec.

This machine consists of a carriage mounted on three-point supports with the piping for the gases all enclosed in the carriage, and all drives protected by dirt-proof casings.

◆ Gall-Proof High-Temperature Thread Dope

A new thread lubricant claimed to be of great value in the assembling of machinery and in the repair of equipment that is subjected to heavy duty, high temperatures and general abuse, has been placed on the market by Armite Laboratories, 1900 East 65th Street, Los Angeles, Calif.

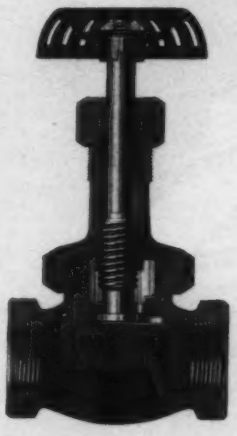
The makers describe the product as being a very finely divided metallic lead in paste form, and claim that in use a film of metallic lead is formed between the threads that prevents galling, speeds up repair work, and will not freeze, nor will pipe threads corrode together, regardless of time as the lead does not oxidize or harden. They also claim that this lubricant when used on liners and fly-wheels facilitates their insertion or removal.

Detailed information about this product will be furnished by the manufacturers upon request.

◆ Non-Metallic Disc Valve

The Lunkenheimer Co., Cincinnati, Ohio, has just announced Fig. 123 "N-M-D," a nonmetallic disc bronze valve suitable for 150 lb. steam pressure and 300 lb. gas-liquid pressure.

The disc holder of Fig. 123 is of the slip-on type—a turn or two of the handwheel before removing the bonnet prevents disc holder from dropping off. Extra long guides insure accurate seating. Lugs are provided for wrench hold when removing disc; the beveled extension protects spud threads.



The stem is made of rolled bronze and is unusually heavy. Long threads are fully engaged with bonnet threads when valve is closed. Shoulder above the stem thread seats tightly against bottom of stuffing box making the valve repackable under pressure.

◆ Helico-Centrifugal Separator

A separator built on the helico-centrifugal principle has been developed by The Swartwout Company, 18511 Euclid Ave., Cleveland, Ohio.

The helix or "cork screw" device which gives the entering steam, air or other vapor a whirling motion is located near the inlet of the separator. Any liquid or solid matter that is entrained is thrown by centrifugal force to the outside of the separator, where it collects, runs down and is drawn off. No baffle plates and other devices which have a tendency to reduce the pressure are employed.

This separator is made in all desirable sizes, styles and capacities.

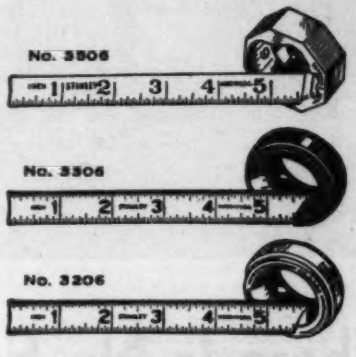
◆ New Line of Drills

Armstrong Brothers Tool Company, Chicago, has added Star Drills to its list of tools. The new line, of the 4-point type and drop forged from special high carbon chisel steel hardened and tempered, is introduced complete with drills in all sizes. Drills 8", 12", 18" and 24" lengths are made in diameters from ¼" to 1" by sixteenth inches; large diameters from 1" to 1½" come by eighths in the 12", 18" and 24" lengths.

◆ New Flexible-Rigid Steel Rules

Stanley Tools, New Britain, Conn., have recently brought out three new Stanley "Pull-Push" Rules. The 6 foot steel blades are both rigid and flexible-rigid for measuring straight, horizontally or vertically-flexible for measuring cylinders and odd shapes.

These rules are so constructed that the blade can be removed entirely from its case and used, light and free, for end to end measurements. Other features



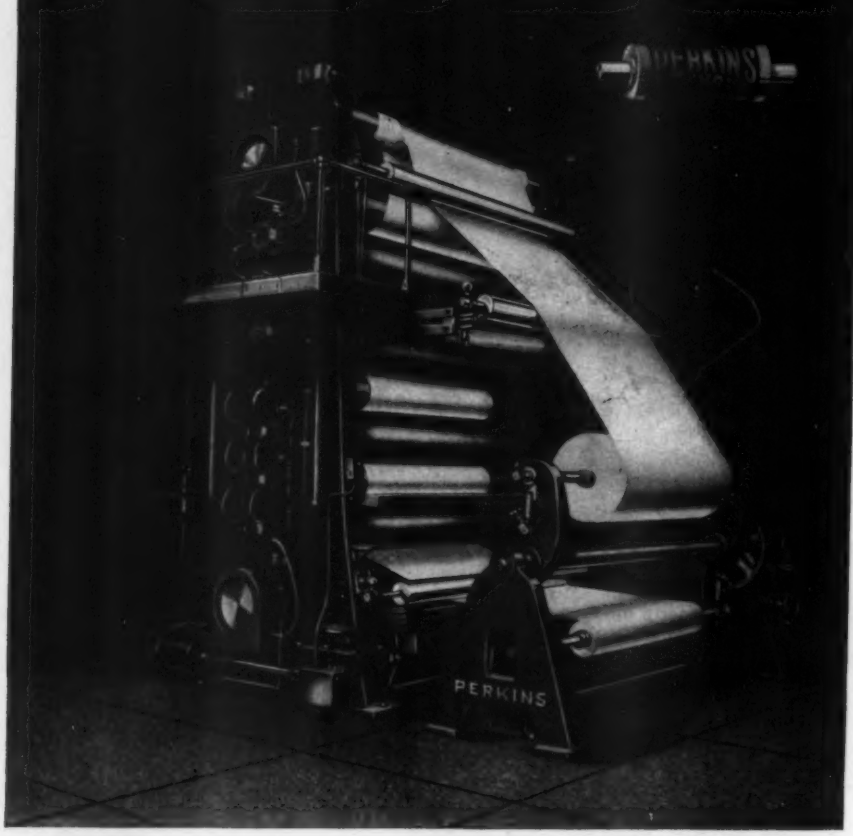
enumerated by the manufacturer are: nickel plated blades; safe "pull-push" blade action; graduations lie close to work; watch size cases, only 2 inches in diameter.

◆ New Beater With Three Bed-Plates

The E. D. Jones Company, Pittsfield, Mass., has announced to the paper industry the development of a new type beating engine known as the Multi-beater. Its physical appearance is similar to that of the standard Hollander except for the use of three bed-plates and cantilever type lighters which give roll adjustment to the true center of the three plates. The manufacturer claims that through careful designing of other items it has been able to successfully apply a principle of beating that heretofore had long been looked upon with skepticism by many papermakers.

All things such as horsepower consumption, stock temperature, flexibility,

PERKINS



Cotton Rolls
Paper Rolls
Embossing Rolls
Chilled Iron Rolls
Granite Press Rolls
Glassine Supercalenders
Web Supercalenders
Friction Calenders
Embossing Calenders
Sheet Calenders
Platers
Mullen Paper Testers
Tensile Testers
Ventilating Fans
Rag Cutters
Stock Cutters
Paper Dampeners
Bleach Ejectors

There Is No Substitute for Perkins Quality

PERKINS Calenders are engineered to meet precisely the manufacturing requirements of the mill in which they are to be installed.

Extreme ruggedness to insure long, uninterrupted service is always an important consideration.

The extra weight, with perfectly balanced construction, is one of the reasons why Perkins Calenders can be operated profitably at speeds beyond present practice.

B. F. Perkins & Son, Inc., Holyoke, Mass.

ENGINEERS AND MANUFACTURERS

fast and proper beating, circulation, mixing, dumping, maintenance, etc., that have been so desirable in beater performance, have not only been maintained in this design, but have in each case been definitely improved.

A 600-lb. Multibeater, running on all rag stock, is equipped with a 75-hp. motor. It has been possible through this installation to reduce beating time 16 hours in 800-lb. beaters to 10 hours in the 1,600-lb. Multibeater with an average horsepower consumption of only 54. This time could again be greatly reduced if a jordan were used.

Circulation is stated to have been speeded up to 55 f.p.m. without lodgments while the temperature rise was only 45 degrees.

It is also pointed out that while this beater is tackled for high grade ledgers and bonds, the unit is flexible enough for the manufacture of blotting. Automatic control of beating is another new feature greatly stressed that makes for fast and uniform beating with great saving in labor.

◆ Floor Resurfacing Material

A new type of floor repair material has been announced by the Stonhard Company of Philadelphia, Pa. This material is mixed with sand and cement and the mortar is laid cold, one-half inch thick. According to the announcement, it will bond to concrete, wood, brick, wood block, asphalt or composition floors and is ready for traffic thirty-six hours after being laid.

◆ Tramrail Switch

A new Tramrail Sliding Switch (patents pending) has been developed by Osborn Tramrail Systems, The Osborn Manufacturing Company, Cleveland, Ohio. This design is said to be revolutionary and a number of features are claimed for it. Among them are: Minimizes necessity for superstructures; fewer supporting fittings required; eliminates bending and fitting curves to switch; eliminates angular rail cuts; and lowers headroom loss.

❖ ❖ ❖

◆ Roots-Connersville Blower Corp.

At the annual meeting of the stockholders of the Connersville Blower Co., Inc., held January 23, action was taken to change the name of the company to Roots-Connersville Blower Corp., thus indicating to the public the units making up the company.

The management of the company will continue as heretofore, without any change in personnel.

◆ THROUGH THE FOREST PRODUCTS Division of the Bureau of Foreign and Domestic Commerce, announcement has been given out that the High Council for the U.S.S.R. Paper Industry has decided to build a mill for the production of sulphate pulp at the Polotov saw mill near Archangel, during the current year. The capacity of the pulp mill will be 16,000 metric tons annually.

◆ New Catalogues and Publications

Air Preheater Corp., New York, N. Y.—This company (under management of The Superheater Co.), manufacturers of the Ljunstrom air preheater, has issued a new bulletin No. 933, which illustrates various applications of this preheater. This bulletin should be of interest to industrial steam power plants and to those interested in industrial heat recovery. Copies on request.

Diamond Alkali Co., Pittsburgh, Pa.—This company has just issued a new 32-page booklet that should be of particular interest to users of liquid chlorine. There is an interesting history of liquid chlorine, its physical and chemical properties, the latest approved methods of handling, application and testing together with a number of useful formulas, tables and graphs gathered through careful research and through the experience of the many industries which this company serves. Copies on request.

Gardner-Denver Co., Quincy, Ill.—A new bulletin introduces this company's new ABH and ABJ Vertical Two-Stage Compressors. This compressor is designed to fit in where one is needed for semi-permanent service on contracting, tunnel and mining jobs, and on industrial work where the demand for air is such that it is not economical to operate a large horizontal compressor at greatly reduced capacity. It is claimed the vertical compressors are well adapted to gasoline or Diesel engines. The bulletin outlines briefly the specifications of this type of compressor and the construction is illustrated by a cross-section diagrammatic photo. Copies on request.

The Harnischfeger Corp., Milwaukee, Wis.—A new publication, Bulletin No. RH-1, treats upon the application of hoists to both general and specific problems. There are illustrations in color with photos of installations and diagrams explaining simplified construction and operation—the booklet lists the ratings and operating ranges for type "R" hoists along with specifications and electrical accessories. Copies on request.

Haynes Stellite Co., 205 E. 42nd St., New York—A new catalogue is devoted to this company's process of hard-facing, which is the process of welding on to wearing parts a coating edge or point of a metal highly capable of resisting abrasion. The catalogue describes a group of materials that are particularly resistant to abrasive wear. There are also illustrations from actual practice showing a few of the many applications where the hard-facing process is said to have saved money for industry.

Hauser-Stander Tank Co., Cincinnati, O.—Catalogue 33 contains 100 pages and cover and contains descriptive matter on every type of tank made by this company. The catalogue is entitled "Wooden Tanks for Every Purpose." There are many tables of useful data and the book is profusely illustrated.

Homestead Valve Mfg. Co., Coraopolis, Pa.—The company has issued a handy pocket edition catalogue of Quarter Turn Valves, which contains among other things, an interesting description of the Quarter Turn Valve Principle which this company has developed and promoted. It also covers a number of 2-, 3- and 4-way hookups for various fluids, gases, vapors of particular interest to industrial piping contractors and engineers. Copies gratis.

Nason Mfg. Co., 71 Fulton St., New York—This company is distributing to any executive or engineer interested a new catalogue entitled "The Solution of Your Condensation Problems." This catalogue explains and gives the solution as experienced by companies in various industries, and also describes and illustrates a complete line of steam traps: bucket, ball float return, etc. This catalogue features and illustrates the different types of Detroit traps and Detroit receivers manufactured by this company, also Ideal ball float steam traps and other Nason items. Many ready reference tables are included.

Timken Roller Bearing Co., Canton, Ohio—A new and revised engineering journal of technical and engineering information has just been published. The book describes the various types of Timken Bearings, and contains technical data on ratings, load calculations, bearing selection and complete information pertinent to the mounting, use and maintenance of Timken bearings. There is also a resumé of the developments of the past few years covering such improvements as steep angle bearings, airplane wheel bearings, NRA double cup bearings, one, two and four row heavy duty bearings, the inverted type of rolling mill bearing and the flanged bearing. The book is made in loose leaf form in an attractive binder.

Worthington Pump and Mach'y Corp., Harrison, N. J.—A series of interesting broadsides is being distributed by this company illustrating and describing its line of portable compressors ranging from 120 to 360 cu. ft. displacement.

BOOKS

Cost and Production Handbook is the title of a recently published book that has been edited by L. P. Alford, M. E., Dr. Eng., with the help of a board of eighty authorities and specialists in cost accounting, manufacturing and engineering. The handbook, consisting of nearly 1600 pages, 619 figures and 170 tables, is literally a one-volume encyclopedia of practical value to production executives and foremen, as well as officials and accountants. It is divided into twenty-eight sections and includes material on reports, budgets and factory organization; production material costs; labor and labor costs; plant equipment and plant costs; determination and control of manufacturing costs; and experimenting and research. It is informative and factual in treatment and presents subject matter designed to aid in controlling and reducing costs. The price of the book has been placed at $7.50 per copy by The Ronald Press Co., 15 East 26th St., New York City, publishers.

The Romance of Paper—Warren B. Bullock, Manager of the Import Committee of the American Paper Industry, New York City, is the author of this new work. The book contains 88 pages and is divided into 14 chapters. In the preface, the author states that the purpose of this book is to give a better appreciation of paper, the most important of all our present-day commodities. He has artfully woven into this work the colorful and romantic threads of the manufacture of this universally necessary product, as observed by him through many years of association with the industry. The book is written in non-technical language; facts and data are accurately stated; and in treating the different grades of paper separately in individual chapters, the author has presented his material in a most interesting and convenient manner. The book is published by Richard G. Badger, The Gorham Press, Boston.

The Preparation and Prosecution of Patent Applications—This book has been prepared by the author, Charles W. Rivise, for the use of patent attorneys, patent examiners, general practitioners, inventors, engineers, chemists, business executives and research directors. Mr. Rivise is a patent attorney of Philadelphia; he was formerly with the examining corps of the U. S. Patent office; is author of "Rivise on Interference Practice," and chairman of the Patents Committee of T. A. P. P. I. This works sets forth in sufficient detail the necessary information to enable one to prepare an application and prosecute it to the issuance of a valid patent of the broadest scope. There are chapters taking up the various phases of patent information, arranged with regard to the sequence of events as they generally occur. Each point is illustrated by the facts and rulings of the most pertinent and up-to-date decisions. The book is published by The Michie Company, Charlottesville, Va., and is priced at $7.00.

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POWER

GENERATION + UTILIZATION + MAINTENANCE

By W. S. JOULE

This section turns the searchlight on power and its allied problems, showing big possibilities to save. Opportunities to improve conditions, methods, apparatus will be discovered. Worth while practices suggest new ideas and wider usages of equipment.

◆ Careless Use of Tools Invites Criticism

It truthfully can be said of the vast majority of engineers that a sense of pride prompts them to keep the equipment within their charge in first class operation condition. Indicator cards will show that they appreciate the full value of properly set valves; a survey of engine rooms will not reveal any steam leaks; in fact, from all general appearances, everything is well kept up.

There are, however, many details which in themselves may not impair the efficiency of a unit, but will show how far an engineer's true pride really goes. Have you ever walked into an engine room and noticed that the cylinder head nuts of a fine looking engine had been tightened with a cold chisel, that the marks of the chisel were plainly visible? When you see this, it certainly detracts form your first impression of both the engineer and his plant. One feels that he is careless either in his own detail work or he is not following closely enough the work of his assistants.

If one looks around a little further, one will probably find where pipe wrenches have left their "bite" on pump rods, and where valve bonnet bolts have been taken up with that same pipe wrench. No doubt plenty of evidence will show that gas pliers have been used on many a small bolt or machine screw, or the nuts of another engine cylinder head although not marred, may present an unsymmetrical appearance which with just a little effort on the part of the engineer could be made symmetrical.

This may be going after the little things, but they all count, not alone because of the criticism of other engineers, but also because of the "big boss," who although he may not be an engineer, has a keen eye for what will appear to him as abuse of his equipment. A little thought on this subject will convince one that an opinion as to one's ability and worth may be based upon some of the little things he does about the plant.

Gaskets especially intended for high pressure steam should be made as thin as the condition of the surface will permit. For machined surfaces, 1/32-in. material will give the best results if the joint is carefully pulled together; thick gaskets leave a weak joint and require a second tightening. To function properly all gaskets must have a certain degree of elasticity which will allow enough compression to fill the pores of the metal surfaces upon which they are placed; beyond this any thickness of material only weakens the joint. That portion of any gasket which does not become an intimate part of the metal which it touches should be reduced to a minimum, for it gradually loses its elasticity with age and becomes hard and dry.

◆ Lubrication Requirements of Diesel Air Compressor

With regard to the lubrication of the air compressors of Diesel engines, care should be taken in feeding oil to the cylinders. So long as the quantity is not excessive and the inter-cooling of the air between the stages of compression is good, nothing more serious than rapid carbonization is likely to occur.

The greatest danger is that if a cheap oil is used, the decomposition will allow carbon to deposit on the valve seats, causing leakage.

◆ Use of Instrument Transformers

It is the function of the instrument transformer to deliver to the instruments and control circuits a miniature reproduction of the voltage and current in the power circuit. The miniature voltage must always be accurately proportional to the voltage in the power circuit and the miniature current must be accurately proportional to the current in the power circuit. Since wattmeters are usually included among the measuring instruments, it is also necessary that the miniature voltage and current correspond closely in phase with the voltage and current in the power circuit.

Since the insulation of the instrument transformers protects the instruments and also the attendants from the high voltage of the power system, it is important that it be of the best quality, ample in quantity and properly placed. Instrument transformers for the lower voltages are often made for operation without oil, but transformers for high voltages are oil immersed. Oil is an excellent insulating and cooling medium and helps to keep the transformer free from the moisture in the atmosphere.

For certain uses of instrument transformers, it is necessary to know the relative direction of the current in the primary and secondary windings. For this reason, the "polarity" of instrument transformers is marked. Some form of marker is put on, or adjacent to, one of the primary leads and one of the secondary leads. The markers are placed so that when current is flowing toward the transformer in the marked primary lead, current will be flowing away from the transformer in the marked secondary lead. Knowing this convention, it is easy to make allowance for the effect of the transformer when connecting instruments or relays.

Instrument transformers operate on the same general principle as all transformers. A current flowing in the primary winding causes a magnetic flux in the iron core. This flux in turn induces a voltage in the secondary coil, thus causing a current to flow if the secondary circuit is closed.

Voltage transformers are made in a large variety of sizes and types. They generally have a small rating, because the only secondary load which they are intended to carry is a few instruments or relays.

An ideal voltage transformer would have zero regulation; that is, its secondary voltage would not change as its load changed. The secondary voltage would bear the rated ratio to the primary voltage, and the secondary voltage would always be exactly 180 deg. behind the primary voltage. These conditions are impossible of exact fulfillment, and the process of voltage transformer design consists in making the best possible approximation to the ideal, considering both cost and performance.

Regulation is made low by keeping the losses and the reactance low. The secondary voltage is then "compensated" for the particular load to be carried. This is done by leaving off a certain number of the primary turns. The actual ratio of the transformer is thus changed just enough to make up for the voltage drop at the given load. The small losses in the transformer insure a small phase angle.

Voltage transformers are used with voltmeters, wattmeters, watthour meters, power factor meters, frequency meters, synchronoscopes and synchronizing apparatus, relays and automatic circuit breaker trip coils. A single voltage transformer can be used for a number of instruments, if the total load does not exceed that for which the transformer is designed and compensated. With instruments which have voltage coils only, such as voltmeters, frequency meters and some relays, no attention need be paid to the polarity of the voltage transformer, nor to its phase angle; but polarity and phase angle must be carefully considered when voltage transformers are used with wattmeters, watthour meters, power factor meters or any device which depends on the mutual action of two independent coils.

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Program of Annual Meeting of T.A.P.P.I.

On Monday morning, February 19, the Technical Association of the Pulp and Paper Industry will join with the American Paper and Pulp Association and its associate members in a general session. At 10 o'clock, Honorary Chairman S. L. Willson, President of the American Paper and Pulp Association, will open the meeting; Allen Abrams, President of T.A.P.P.I. will be the presiding officer. The session will be given over to a Symposium on Paper Classification and standards, in which the following will participate:

Remarks—by George Carter, Public Printer, Government Printing Office, and L. J. Briggs, Bureau of Standards.

"Economic Significance of Paper Specifications" by J. E. Plumstead, Manager Jessup and Moore Paper Co.

Merchants Viewpoint—Representative of National Paper Trade Ass'n.

Consumers Viewpoint—Fred Schlink, Consumers Research, Inc.

"Necessary Laboratory Studies for Preparing Specifications" H. F. Lewis, Institute of Paper Chemistry.

Following is a schedule of subjects to be taken up various sessions of T.A.P.P.I.:

Monday Afternoon, February 19

"Use Requirements and T.A.P.P.I. Facilities for their Study," C. C. Heritage, Oxford Paper Co.

"Trade Names and their Significance," F. C. Clark, Skinner & Sherman, Inc.

"Results of T.A.P.P.I. Questionnaire on Use Requirements of Paper," C. E. Curran and P. K. Baird, U. S. Forest Products Laboratory.

Tuesday, February 20

General Session—Allen Abrams presiding.

Report of Secretary
Address by President
Report of Joint Textbook Committee
Development Reports by Division Chairmen
(Report by Dr Herty of W. G. MacNaughton on work progress at Savannah Laboratory.)

Engineering Division—M. H. Teaze presiding.

"Modern Lighting Practice on Pulp and Paper Mills," by W. S. Hadaway, Westinghouse Lamp Co.

"Switchgear Developments of Interest to the Pulp and Paper Industry," by G. M. Reed, General Electric Co.

"Mechanical Power Transmission from Motor Drive to Industry," by F. U. Parkhurst, Rockwood Manufacturing Co.

"Aluminum Foil for Heat Insulation," by E. B. Svenson, Aluminum Company of America.

"Steam and Power in the Pulp and Paper Industry," by W. P. Govit, United Engineers and Constructors, Inc.

Management Division—W. M. Shoemaker presiding.

"Possibilities of Standardizing Materials Purchasing Specifications," by A. E. H. Fair, Alliance Paper Mills, Ltd.

"Co-ordination of Research, Technical Control and Mill Operation," by K. A. Taylor, Oxford Paper Co.

Symposium—"Organization and Operation of Training Progress for the Industry," led by H. G. Noyes, personnel manager, Oxford Paper Co.

Converting and Consuming Division—A. W. Nickerson and J. J. O'Connor presiding.

"Viscosity Testing of Coating Color," by Parker Dunn and C. G. Landes, Mead Corp.

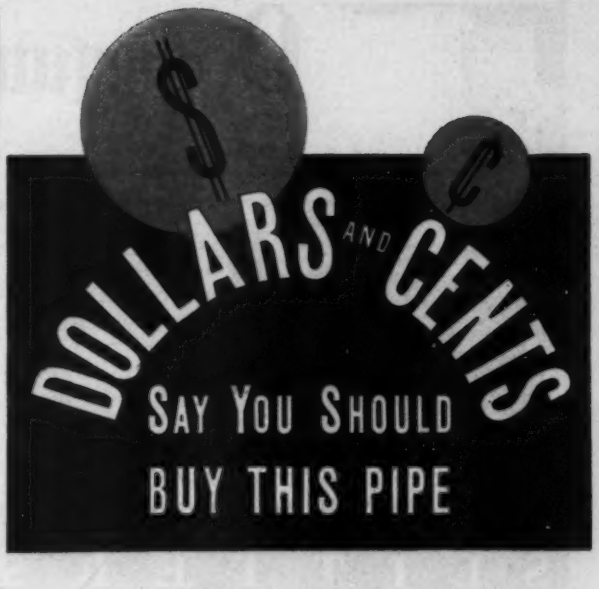
Coating Questionnaire Results Discussion.

Round Table Discussion on Coating Problems, led by J. J. O'Connor.

Wednesday, February 21

Operating and Engineering Divisions—F. C. Clark and M. H. Teaze, presiding.

"Rate of Drying News Print," by F. W. Adams, Massachusette Institute of Technology.



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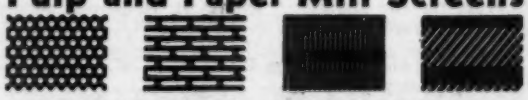

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"Use of White Water on Cylinder Machines," by F. C. Stamm, Upson Co.

"Power Requirements of Paper Mill Machinery," by R. Trautschold.

"Friction Materials in the Paper Industry," by J. Hemphill.

Testing and Raw Materials Division—R. C. Griffin and J. L. Parsons, presiding.

"Processing Variables in Evaluating Pulp by the Pebble Mill," by C. E. Curran, Forest Products Laboratory.

"A Comparison of Several Methods for Processing Pulp Test Samples," by H. W. Morgan, New York State College of Forestry.

"Bleach Consumption of Pulp," by R. H. Wiles, International Paper Co.

"A Sizing Test and Its Application," by R. M. Cobb and D. V. Lowe, Lowe Paper Co.

"A Modification of the Bright Stain and Procedure for Malachite Green in Determination of Bleached and Unbleached Fibers in Paper," by M. S. Kantrowitz, Government Printing Office.

"Pulp Testing and Specifications Survey," by Helen U. Kiely.

Operating and Research and Development Division—F. C. Clark and C. E. Curran, presiding.

"Changes in Fiber Structure During Cooking and Bleaching," by C. H. Carpenter and H. F. Lewis, Institute of Paper Chemistry.

"Effect of Chip Length in Sulphite Pulping," by J. N. McGovern and G. H. Chidester, Forest Products Laboratory.

"Deinking Telephone Directories," by S. D. Wells, Combined Locks Paper Co.

"Mclaren-Snyder Deinking Process," by Stanley Maclaren.

"Heat Utilization (a) in Sulphite Pulping; (b) in Alkaline Pulping," by W. T. Webster, Ross Engineering Corp.

"Voith Pneumatic Conveying System," by Chris Crusius, J. M. Voith Co.

Operating Division—D. Manson Sutherland, Jr., presiding.

"Beater and Jordan Control," by G. Lamont Bidwell, Jr., Riegel Paper Corp.

"Notes on Continuous Refining," by D. Manson Sutherland, Jr. (Chairman T.A.P.P.I. Stuff Preparation Committee).

Round Table Discussion on Stuff Preparation, headed by D. Manson Sutherland, Jr.

Thursday, February 22

Engineering and Management Divisions—M. H. Teaze and W. M. Shoemaker presiding.

"Economical Generation of Steam in Industrial Plants," by R. A. Foresman, Westinghouse Elec. & Mfg. Co.

"Relations and Arrangements between Utilities and the Paper Industry," by V. E. Alden, Stone & Webster, Inc.

"Standard and Comparison Power Plant Reports," by A. G. Darling, Chairman T.A.P.P.I. Patents Committee.

Operating Division and Color Committee—F. C. Clark, presiding.

"Beater Addition of Titanium Pigments," by W. R. Willets, Titanium Pigment Co.

"Zinc Sulphide Pigments in Today's Paper Industry," by V. A. Belcher, New Jersey Zinc Co.

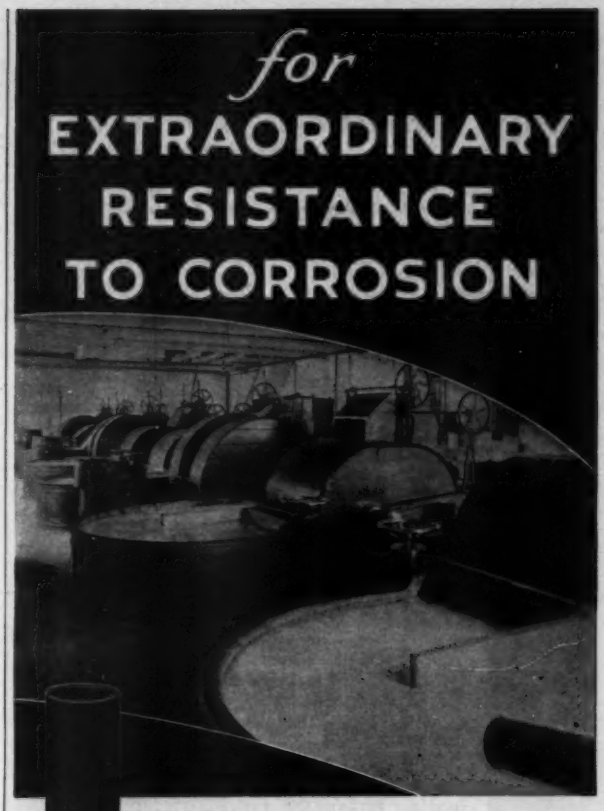
"Color Standards," by J. L. Parsons, Chairman T.A.P.P.I. Special Color Committee.

Annual Luncheon—Allen Abrams, presiding.

T.A.P.P.I. 1934 Fall Meeting at Portland, Ore., Committee Program.

Election of Officers.

Speaker, W. W. Pickard, Deputy Administrator, Paper Division, National Recovery Administration.



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Complete power plants to meet any operating conditions of Pulp and Paper mills or other industrial service. Engineering and Construction.

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FERGUSON ENGINEERS

Power Specialists
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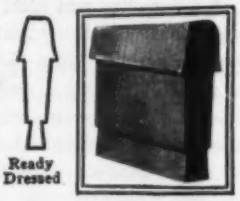
THE MOST ECONOMICAL FILLING THAT CAN BE PUT IN A MORTISE WHEEL



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SYRACUSE — ROLLWAY CYLINDRICAL ROLLER BEARINGS — NEW YORK

HUDSON SHARP Machine Company

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MANUFACTURERS OF THE MOST MODERN AND COMPLETE LINE OF PAPER CONVERTING MACHINERY IN THE WORLD. YOUR INQUIRIES ARE RESPECTFULLY SOLICITED.

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pH Control—Boiler Feedwater Control—
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Standard Routine Tests Developed by LaMotte Research Department Promote Better Control of Processes

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in the Beaters
in the Sizing
in Filling, Coating, and Coloring
in Eliminating Deposition of Pitch on Wires, Rolls and Felts
in White Water Recovery
in Quality of Mill Water Supply
in Finished Paper

CHLORINE CONTROL
in Treating Mill Water Supply, etc.

BOILER FEED WATER CONTROL
Simplified Outfits for Controlling Treated Water or in Analyzing Untreated Water for: Alkalinity . . . Chlorides . . . Dissolved Oxygen . . . Hardness . . . Phosphates . . . pH . . . Sulphates

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BLEACH TANK WHITE

Formerly known as DAIRY WHITE.

BLEACH TANK WHITE will actually protect metals from corrosion and make unnecessary the immediate replacement of metal parts which may be causing poor quality pulp. Acid and alkali proof.

Dries by evaporation in a few minutes, can be applied over damp surfaces and becomes very glossy when dry.

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The Paper Industry Safety Contest

July 1, 1933 to June 30, 1934

Scores as of December 31, 1933 (Cum.)

12 Perfect Scores

PERFECT SCORES

Division I—Paper and Pulp Mills

	PARTICIPANT	MILL	LOCATION
GROUP A			
GROUP B	St. Croix Paper Co.	Woodland	Maine
GROUP C			
GROUP D	Upson Company	Lockport	New York
	Hollingsworth & Whitney Co.	Aroostock & Cobbassee	Gardiner, Me.
	International Paper Co.	Continental Div.	Ashland, N. H.
	Bird & Son, Inc.	Roofing Plant	Chicago
	International Paper Co.	Livermore	Maine
	International Paper Co.	Riley	Maine
	Hollingsworth & Whitney Co.	Abenaquis	Madison, Me.
	Spaulding Fibre Co., Inc.	Hayes	No. Rochester, N.H.

Division II—Remanufacturing

Container Corp. of America	Natick	Massachusetts
Southern Container Co.	Houston	Texas
Bemis Bro. Bag Co.	E. Pepperell	Massachusetts

IMPERFECT SCORES

	Key	Rank	Points Credit	Points Debit
GROUP A	PB- 9	1	949.426	
	PA- 2	2	938.670	
	PA-17	3	931.186	
	PA- 6	4	843.630	
	PA- 5	5	652.830	
	PB- 5	6	637.434	
	PA- 1	7	605.300	
	PA- 4	8	559.888	
	PA- 3	9	456.774	
	PA- 8	10	448.526	
	PB- 8	11	413.650	
	PA-14	12	266.642	
	PB- 2	13	187.840	
	PA-16	14	113.798	
	PA-12	15		132.758
	PA-13	16		141.950
	PA-15	17		147.890
	PA- 7	18		441.038
	PA- 9	19		449.606
GROUP B	PC-10	2	904.040	
	PB- 6	3	837.974	
	PB- 7	4	796.350	
	PB- 3	5	724.854	
	PB-15	6	547.312	
	PB- 1	7	545.518	
	PC- 7	8	467.994	
	PB-11	9	460.962	
	PB-16	10	457.130	
	PB-13	11	148.454	
	PC- 2	12		617.742

DIVISION II

RC- 1	4	907.778	
RC- 4	5	756.424	
RC- 5	6	672.726	
RD- 4	7	659.928	
RD- 5	8	639.338	
RD- 1	9	630.054	
RC- 2	10	361.826	
RC- 3	11	219.502	
RD- 6	12	188.360	
RD- 7	13		1,183.408

	Key	Rank	Points Credit	Points Debit
GROUP C	PC- 6	1	870.582	
	PC-25	2	860.310	
	PC-22	3	731.358	
	PD-28	4	701.734	
	PC-24	5	613.278	
	PB-10	6	573.930	
	PC-11	7	517.378	
	PD-17	8	454.216	
	PC- 3	9	412.570	
	PD-25	10	392.978	
	PC-21	11	296.874	
	PD-13	12	238.958	
	PC-27	13	160.464	
	PC- 4	14	156.850	
	PC- 8	15	138.334	
	PB-17	16	136.368	
	PC-23	17	105.678	
	PC- 9	18	89.450	
	PC-18	19		53.152
	PC-12	20		272.898
	PC-16	21		288.874
	PC-13	22		394.448
	PC-10	23		404.630
	PB-18	24		804.554
	PC-26	25		1,088.154
GROUP D	PD- 9	9	666.590	
	PD- 1	10	605.922	
	PD- 3	11	578.432	
	PD-27	12	550.338	
	PD- 6	13	438.782	
	PD-26	14	353.032	
	PC-20	15	343.726	
	PD- 7	16	194.656	
	PD-14	17		89.430
	PD-12	18		373.338
	PD-11	19		395.966
	PD-20	20		466.378
	PD- 8	21		831.096
	PD-29	22		1,814.146
	PD- 2	23		2,206.816

No December Report: PA-11; PB-4; PC-14; PC-15; RB-1.
No November or December Report: PB-14.
Withdrawn: PA-10; PB-12; PC-5; PC-17; PD-21; PD-22; PD-23; RA-1.

◆ **THE NATIONAL SAFETY COUNCIL recently announced that Cleveland, Ohio, has been chosen as the convention city for the Twenty-third Annual Safety Congress. The dates set are October 1 to 5, 1934. Earl Grant, of The Crystal Tissue Co., Middletown, Ohio, is chairman of the Program Committee for the Paper and Pulp Section. The committee will welcome suggestions and new ideas on the type of speakers and the subjects to be discussed.**

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RYERTEX BEARINGS

—CLEANER —LAST LONGER

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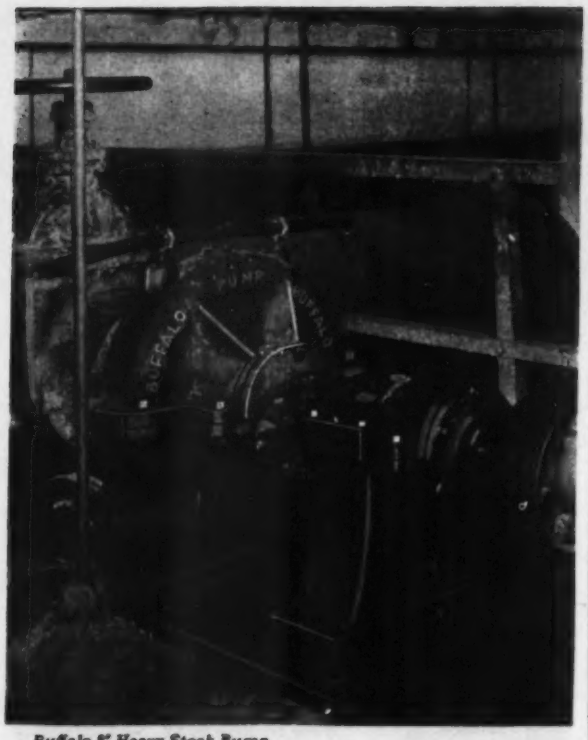

Buffalo 8" Heavy Stock Pump handling 1500 g. p. m. of 5½% paper board stock against 35' head, on beater service.

Modernize your pumping equipment-- NOW!

Many a mill superintendent has asked for new equipment without hope of getting it—but it's a different story now! Your requisition for needed material has every inducement behind it now. Rising material costs, probable increase in manufacturing costs and many other factors indicate that NOW is the time to modernize your pump equipment. Our engineers are glad to make recommendations.

Buffalo Pumps, Inc.
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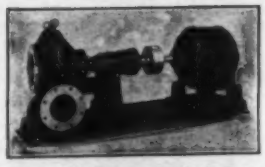
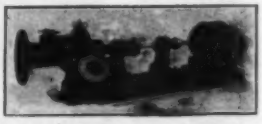
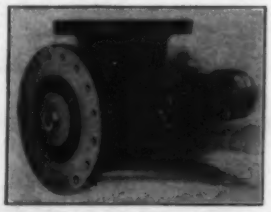
"Buffalo" paper stock pumps



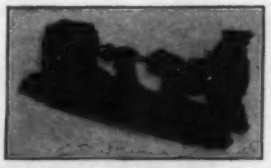
For Installation in Limited Space. Suction Connection Omitted. Close-Coupled Single Bearing Pedestal Used on this Buffalo Non-Clogging Stock Pump.



High Consistency Pump with Two Pedestal Bearing Construction Used in Many Installations.



The Buffalo Rotajector which will Handle Stock of Any Consistency that Will Flow and Reach to Impeller.



Type CHO Used for Handling Black Liquors, Caustic, Sludge and Various Acids.

No other pipe
combines these qualities

In those services for which it is intended, Taylor Spiral pipe possesses advantages that set it above and apart from all other types of pipe.

It is stronger than a SEAMLESS pipe of equal thickness. It has stiffness and rigidity far beyond any other type of pipe of equal weight. It retains its arrow-straightness and perfect-circle roundness under bending strains and collapsing pressures that would distort any other type of pipe of equal weight.

And it offers these PLUS qualities at a lower price than any other type of pipe.

Taylor Spiral Pipe is available riveted or welded, heavily galvanized, or hot-dipped in asphalt. It is also furnished in Armco Ingot Iron. A full range of joints and couplings simplify the application in all phases of paper mill service.

Ask for new catalog covering the long record of service of Taylor Spiral Pipe and the manufacturing resources and facilities that are behind this record.

Taylor Forge & Pipe Works
General Offices and Works:
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TAYLOR
SPIRAL PIPE
Riveted or Welded

The COMMERCIAL OUTLOOK

New York, February 1, 1934.

ON all sides are concrete indications of improvement in the paper industry, and the improvement is of the healthiest character—gradual yet steady in its development and based on such sound fundamentals as broadening demand, expanding consumption and increasing requirements of consumers and converters. The industry still has a good way to go before it can be said to be in a normal condition; that is, from a production standpoint. True enough, demand as yet is well below the aggregate volume seen in active business periods in the past, but there is a consistent growth in the call for paper supplies, and the trend is in a forward direction. In comparison with the situation prevailing only a few months ago, the present state of the market is so much more favorable that the position is scarcely comparable.

Reports reaching New York indicate that the pick-up in paper manufacturing since the quiet spell during the holiday and inventory period varies in the different sections of the country. Paper mills in the Ohio Valley district appear to be busier than in any other part of the United States. Manufacturing operations in mills in the Kalamazoo book paper district have been increased to some extent, yet papermaking plants there are still far from rushed. The situation in the Holyoke fine paper district continues slow, certain mills Down East are managing to keep passably engaged but most fine paper mills are running on greatly curtailed schedules. Mills in Pennsylvania, New York and other parts of the East are mostly moderately busy, though, depending on their kind of product, some are considerably busier than others.

Sentiment within the industry is confidence personified, it might well be stated. This is not at all surprising because confidence, if not enthusiasm or extreme optimism, abounds almost throughout busines and industrial circles. There is ample reason for this feeling of reassurance. Business not only has scored marked expansion but is going forward steadily; since the outset of the new year additional distinct improvement has been recorded in numerous directions. Retail trade all over the country is gaining at a constant pace; wholesalers and retailers alike are buying in much larger volume; some of the basic industries like the automobile manufacturing industry are stepping up production beyond levels seen in some years; commodities and securities are mounting in value, and the whole trend of matters is such as to instill confidence and prompt the belief that even better things are ahead.

Prices of paper and board exhibit greater firmness than has been witnessed at any time since prior to the depression, and this notwithstanding the fact that market levels have been gradually elevated until they are now higher than in a lengthy while. No longer are manufacturers on the weak side when negotiating sales of paper; quotations are being steadfastly adhered to, and buyers have come to a conclusion that they cannot beat down prices and consequently are meeting the figures quoted without hesitation. The degree of stabilization reached by prices is, in fact, resulting in stimulating business in paper because consumers and converters are not delaying covering their requirements while feeling there is more likelihood of them having to pay more than less for paper supplies in the near future.

Production of newsprint in the United States in December amounted to 80,895 net tons, compared with 87,567 tons in the preceding month, while shipments from mills were 82,031 tons, against 86,829 tons in November. Production in Canada in December was 175,304 tons, contrasted with 193,718 tons in the month before, and shipments were 172,285 tons, against 201,102 tons, making a total United States and Canadian output of 256,199 tons, compared with 281,285 tons in November, with shipments aggregating 254,316 tons, against 287,931 tons in November.

Taking the production of newsprint mills which reported monthly and allowing for necessary year end corrections and adjustments, the total North American output of print paper in 1933 is calculated to have reached 3,250,579 tons, of which 2,017,004 tons were made in Canada, 946,374 tons in the United States, 270,834 tons in Newfoundland, and 16,367 tons in Mexico. The Canadian production was 5.3 per cent more than in 1932, that in the United States 6.2 per cent less, with a loss of .4 per cent in Newfoundland and 29 per cent gain in Mexico, making a total continental increase of 43,188 tons, or 1.3 per cent. Stocks of newsprint at Canadian mills at the end of 1933 amounted to 33,847 tons, and at United States mills 18,566 tons, making a combined total of 52,413 tons, compared with 64,137 tons at the end of 1932.

Figures compiled by the Census Bureau of the U. S. Department of Commerce show that production of paperboard in the United States in November last amounted to 206,933 net tons, compared with 228,416 tons in the preceding month, mills producing at 54.1 per cent of their rated capacity during November, against 60.1 per cent in October. New orders received by mills in November totaled 199,059 tons, against 185,026 tons in the month before, while unfilled orders held by manufacturers at the end of November called for 55,080 tons, contrasted with 62,177 tons a month earlier. Shipments of board from mills during November aggregated 175,148 tons, compared with 191,989 tons in the preceding month, and stocks of board at mills at the close of November were 72,463 tons, against 63,315 tons a month before.

A proposed agreement between United States and Canadian newsprint manufacturers, and a code provision that paper shall not be sold for delivery during 1934 at less than a base price of $41 a ton, are among the recommendations made by the code authority of the newsprint industry. A public hearing will be held February 1 in Washington before Deputy Administrator W. W. Pickard. The code authority recommends additions to trade practices of the code. One change would empower the authority to adjust or modify existing minimum prices, if justified by general changes "in the cost of manufacturing or in the value of the dollar and by conditions in the newspaper publishing industry." Machinery is set up for making and protecting minimum prices and for fair trade practices, including a zoning scheme for price determination in the United States.

Kraft wrapping paper is quoted at 3.87½ cents per pound delivered in carloads for the standard grade testing 80 per cent, and at 4.12½ cents delivered for super standard testing 90 per cent or higher. Book paper prices are steady to firm, with mills adhering strongly to the quotations named. Writing paper is marked by a firm quotational tone, as are tissue, cover, bogus, blotting and other papers. Quotations on plain box boards are maintained at $45 a ton for news and $42.50 for chipboard in the East, delivered in New York City.

❖ ❖ ❖

◆ PAPERMAKING machines in use in the United States during 1932 numbered 1609, with a total output of paper and board of 7,997 short tons. Machines in use in 1928 numbered 1702 with a combined output of 10,403,338 tons. In the following year the number of machines in use dropped to 1,645, while paper and board production rose to 11,140,235 tons, the high-water mark in the output of these products in the United States. This information is taken from Side Runs of the Paper Trade, published by the Bureau of Foreign and Domestic Commerce.

◆ MASON-NEILAN Regulator Co., Boston, announces that Donavon B. Church has been transferred from the San Francisco branch office to the factory engineering department, Boston. Mr. Church has had wide experience in the oil process industries as a control engineer.

-when paper must have "two sides"

KREBS PIGMENTS

For Paper Makers

TI-TONE P

This is an ideal, all-purpose, medium-priced pigment for increasing opacity. It consists of Ponolith HO fortified with 15% Titanium Dioxide.

PONOLITH HO

This pigment contains approximately 30% zinc sulphide. It is low in cost and is recommended for use in the manufacture of paper where a high pigmentation is permissible.

TITANIUM DIOXIDE

Titanium Dioxide has a high index of refraction and is the strongest known pigment to impart whiteness and opaqueness to paper.

PAPER MAKERS use Krebs white pigments when the "show through" must be reduced to a minimum. These pigments are being used in increasing volumes for they give an exceptional opacity and brighter whiteness. Because of its high refractive index . . . .

TITANIUM DIOXIDE

. . . . is the strongest known pigment to impart whiteness and opaqueness to paper. It wets freely . . . disperses evenly . . . has high retention properties. A small percentage of this pigment added to the beater greatly increases the opacity of the finished paper . . . the whiteness of the paper is also substantially improved. Titanium Dioxide is economical to use where maximum opacity is required and where only a small amount of pigment is permissible.

Investigate the distinctive properties of Krebs white pigments. We will be glad to have a member of our technical staff show you how Krebs pigments can improve the quality of your paper. Write today for samples, complete information and technical service.

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THERE'S A KREBS PIGMENT FOR ALL TYPES OF PAPER

Domestic RAW MATERIALS

◆ Old Paper

Market prices of waste paper are ruling about stationary, with slight advances recorded in some centers though with values on the whole simply holding their own. The tendency is higher, however, and members of the trade are predicting increases during February when it is expected consumers will be more actively in the market as buyers. The high quality grades show relatively more firmness than the low or bulk grades. In the East, No. 1 hard white shavings are quoted at 2.40 cents a pound f.o.b. shipping points, No. 1 soft white shavings at 2.10 and 2.15 cents, and No. 1 hard white envelope cuttings at 2.65 cents. Kraft grades have in some cases stiffened in price to around 1.20 cents for No. 1 old kraft, 1.75 cents for new kraft cuttings, and 1.30 cents for kraft corrugated cuttings. Book stock is fetching 90 cents and perhaps higher per hundred pounds for No. 1 heavy magazines, and ledgers and writings have moved upward in value to 1.50 cents a pound for all-white and 1.10 cents for colored ledger. Folded news is selling in the East at 50 to 55 cents per hundred pounds at dealers' points, and No. 1 mixed paper at 25 to 30 cents, while the Middle West market is 60 cents for folded news and 40 cents for mixed paper f.o.b. shipping points.

◆ Papermaking Rags

Nearly all descriptions of papermaking raw material are possessed of a firm price tone, and some items have registered fairly sharp advancement since the outset of the new year. This strength in prices seems due, in many instances, as much to the supply situation as to demand from consuming quarters, and also in good part to the bullish attitude adopted by those handling and supplying materials to paper mills.

Several classes of papermaking rags have scored appreciable price advances. Roofing stock—the lowest grade of rags used by paper mills—has shown the sharpest rise. Sales of domestic No. 1 roofing rags have been recorded at 1.20 and 1.25 cents per pound f.o.b. shipping points, while No. 2 stock has realized 75 and 80 cents per hundred pounds. Foreign linsey garments have been sold at 1.50 cents a pound ex dock American Atlantic ports, and possibly at slightly above this price, while imported dark cottons have brought 1.20 cents per pound. The tendency in such rags, both domestic and foreign, continues upward, and dealers put much emphasis on the small quantities available at supply sources. The story is told of a certain roofing felt mill entering the market for foreign linsey garments, and of several importers sending cables to a dozen or more shippers in various parts of Europe bidding a very attractive price, and of but two lots totaling 85 tons being offered from abroad, whereas ordinarily an inquiry of this character would have elicited offers of some hundreds of tons of these rags.

New cotton cuttings exhibit price strength, and dealers are exerting very little effort to sell while anticipating higher prices and satisfied to wait out the market. It is nothing uncommon for dealers to quote 6.75 and 7 cents a pound f.o.b. shipping points to fine paper mills on No. 1 white shirt cuttings, and some are refusing to sell at less than these figures. Soft unbleached muslins are quoted at 7.25 cents per pound, light silesias at 4.50 cents, blue overall cuttings at 4.50 cents, fancy shirt cuttings at 2.25 and 2.50 cents, washables at 2.25 cents, khaki cuttings at 4 cents, light flannelettes at 4.50 cents, and bleached canton flannels at 5.50 cents. New white linen cuttings are generally held at 10.50 cents or more, and grey linen at 8.50 cents a pound.

Demand still lags for old white cottons and thirds and blues, and it is said the principal movement of old whites is for export to Europe, some sizeable sales abroad having been made in recent weeks. No. 1 repacked whites are reported available to paper mills at around 2.75 cents a pound f.o.b. dealers' points, No. 2 whites at 2 cents, and repacked blues at 1.40 cents.

◆ Rope and Bagging

The quotable basis on old manila rope is unaltered at 2.50 cents a pound f.o.b. shipping points, but paper manufacturers are said to be engaging in little buying. Apparently, there is apprehension over the probable effects of the compensating tax on rope papers going into heavy bags, and besides it is stated most consuming mills have fair-sized stocks of old rope. Foreign rope is on an identical price level but it is hinted that sales are being made by importers at somewhat under the 2.50c basis. Old bagging is in moderate demand and quotably firm No. 1 scrap bagging is bringing 1.10 cents to slightly higher in some sales, at shipping points. Roofing bagging is approximately 60 or 65 cents a hundred pounds f.o.b. dealers' points.

◆ Pulpwood

Pulpwood prices are firm and show a rising tendency, according to reports from cutting districts. Consuming mills are taking supplies freely against contracts, and make occasional entrances into the market to augment stocks.

◆ Chemical Pulp

It can be stated that market prices of domestic chemical wood pulp are on stationary levels for the time being, as a result of the minimum prices established under the pulp industry code. Whether they will ascend in the weeks to come remains to be seen—depending, of course, on market conditions of demand and supply—but producers are supposed not to sell under the price basis agreed upon, and are now adhering firmly to the minimum levels. Prime bleached sulphite is 2.75 to 2.90 cents a pound ex dock basis Atlantic seaboard, with higher or special qualities 3 and 3.25 cents, while prime unbleached sulphite ranges from 2.10 cents ex dock for news grade up to 2.20 cents for better qualities, and 2.25 and 2.30 cents for easy bleaching and Mitscherlich grades. Domestic kraft pulp is quotable at 1.75 cents per pound upwards to 2 cents and higher, depending on quality, while bleached soda pulp is 2.50 cents delivered at book paper mills. Another advance of $5 a ton in bleached soda pulp appears pending, judging from reports emanating from manufacturing sources. Demand for pulp is fair; there has been some expansion of buying since the first of the year yet the present movement is largely against contracts. It is generally acknowledged that paper and board mills have substantial stocks of pulp, probably larger than they normally carry, and additional buying is being done with greater caution than a few months ago when the pulp purchasing spurt was in full blast.

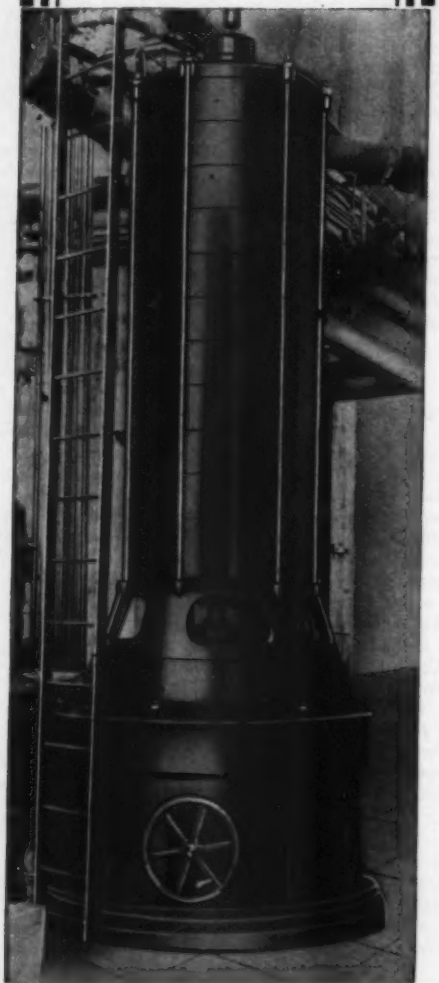
◆ Mechanical Pulp

The market for mechanical pulp is firm of tone and there is a fair volume of business for this period of the year reported. However, demand is not of very broad compass, and prices seem to be simply holding their own on fully sustained levels. Canadian groundwood is selling to American consumers on a price range of $29 to $33 per short ton delivered in Upper New York State or other consuming sections, depending on the freight from grinding centers, the air dry test and the quality of the pulp concerned. Producers across the border are stressing the increased cost of wood and are said to be flatly refusing, in most cases, to accept below certain figures when making sales, $22 a ton representing about the lowest price they will entertain on a f.o.b. pulp mill basis. Such little domestic groundwood as is sold in the open market is reported bringing in the vicinity of $27 a ton at pulp mills, depending on the haul to consuming plants.

◆ Chemicals

Quoted prices of papermaking chemicals exhibit firmness and manufacturers in general are adhering to the figures asked. Bleaching powder is 1.90 to 2.10 cents a pound, in drums, f.o.b. works. Soda ash is 1.40 cents a pound, in carload lots packed in bags, at works, and caustic soda is 2.60 cents upwards a pound for the solid product f.o.b. producing points. Casein is quoted at 11.75 cents per pound for the domestic standard ground and 12 cents for finely ground, while Argentine casein is 13.50 and 16 cents for the standard and finely ground, respectively. Special papermakers' starch is priced at 2.67 cents per pound, in bags, at works.

Improve Quality and Cut Costs



This machine is one of six that have been helping the National Paper Products Company, Port Townsend, Washington, to make a superior sheet of kraft paper from hemlock wood fiber for five years.

Among the many advantages in the use of the FRITZ REFINING and HYDRATING MACHINE are the following:

It will enable the user to run a longer fiber than can now be done, thereby making a stronger sheet with less jordaning, which means saving power.

It will brush out fibers better than can be done by present methods.

It will help in clay retention.

The sheet will pick up from the rolls better, allowing the machine to be speeded up.

There will be less "broke," enabling the mill to make more **good** paper.

It will impart a quality to the sheet that cannot be secured by other methods.

In brief, it will enable the mill to make better paper at less cost. If interested in accomplishing these results, write us for further information.

LOVE BROTHERS, INC.
AURORA, ILLINOIS

Import and Export MARKETS

IMPORTS

◆ Wood Pulp

Under the code of fair practice for the wood pulp industry, minimum selling prices on chemical pulp are established, and these basic prices apply also to imported pulp. Prices on bleached sulphite begin at 2.75 cents per pound for prime quality ex dock basis at Atlantic and Gulf ports of the United States and range up to 2.90 cents, according to quality, with some of the special high grades of bleached sulphite 3 and 3.25 cents. Prices agreed upon for unbleached sulphite start at 2.10 cents a pound ex dock and run up to 2.25 and 2.30 cents for easy bleaching and Mitscherlich sulphites, progressing from the low to the high levels by stages of 5 cents a hundred pounds or $1 per ton. Prime kraft pulp prices range from 1.75 to 1.90 cents a pound.

Domestic manufacturers and importers and agents are supposed not to sell pulp under these basic prices. Higher prices may be obtained when and if the market should register advancement. With these prices now in vogue, the chemical pulp market has attained a degree of stabilization not witnessed in the past. The theory is that pulp producers will know what they can get for their product, and that paper manufacturers will be aware of what they will have to pay to procure their principal raw material.

There has been a noticeable increase in buying interest in wood pulp recently. For a time during the holiday and inventory period, and for the first couple of weeks in the new year, the market ruled quiet decidedly, but meanwhile consumers have been more actively in evidence as buyers and reports tell of some sizable tonnage sales having been made. Certain paper and board manufacturers are said to be expressing readiness to contract for supplies for forward shipment from abroad as far ahead as the end of 1935, provided, of course, they are afforded some guarantee against market price declines. Most consuming mills throughout the United States are understood to be well stocked with pulp, and still having considerable tonnage to be delivered on contracts; nevertheless there is a distinct buying tendency noted, and the market is developing fair trade activity. Some contracts are now also being arranged on an exchange guarantee basis, whereby buyers agree to pay for pulp at exchange differences at time shipments are made from abroad should sterling or kroner exchange rise beyond levels stipulated in the contracts.

Imports of wood pulp into the United States in November last reached a very high volume, and are believed to have established a new total in any single month. Receipts of chemical pulp of all grades amounted to 195,387 long tons, of a declared value of $7,006,171, according to official U. S. Department of Commerce figures, compared with 170,677 tons of a value of $6,112,297 in the preceding month, and 128,275 tons of a value of $4,431,850 in the similar 1932 month. The November imports brought the total for the first eleven months of last year up to 1,404,257 long tons, valued at $48,890,557, contrasted with 1,015,499 tons of a value of $39,066,771 in the corresponding period of 1932.

Groundwood imports in November were 23,136 long tons, valued at $452,482, making a total for the first eleven months of the year of 173,515 tons of a value of $2,968,393, against 152,422 tons of a value of $2,970,138 in the same time of 1932. Current quotations on foreign groundwood of Scandinavian origin are around $29 per short ton ex dock American Atlantic ports for dry, and $27 to $28 for moist.

◆ Paper

In point of total value, imports of paper into the United States showed a slight falling off in November last, amounting to $7,136,484, compared with $7,568,120 in October last year, and making a total for the first eleven months of 1933 of $70,365,163, against $91,996,541 in the similar period of 1932. Standard newsprint, to the value of $62,532,774, comprised the leading paper import item during the first eleven months of last year, while cigarette paper, imports of which reached a value of $2,814,525, was the second important class of paper imported in the same period.

◆ Paper Stock

Papermaking rag importations into the United States continued to decline in November last as compared with the preceding month, amounting to 11,097,490 pounds of a value of $107,292, against 14,146,121 pounds of a declared value of $138,498 in the month before, and 10,894,277 pounds of a value of $105,779 in November, 1932, according to U. S. Department of Commerce statistics. Imports during the first eleven months of the past calendar year totaled 159,577,257 pounds, valued at $1,264,415, contrasted with 86,600,753 pounds of a value of $1,134,425 in the corresponding 1932 period.

Imports of miscellaneous paper stock, including old rope, bagging, waste paper, etc., in November last amounted to 8,136,355 pounds, valued at $104,072, against 9,837,039 pounds of a value of $136,667 in the preceding month, and making an aggregate for the first eleven months of 1933 of 97,294,533 pounds of a value of $1,043,165, against 78,817,620 pounds of a value of $717,721 in the similar time of 1932.

EXPORTS

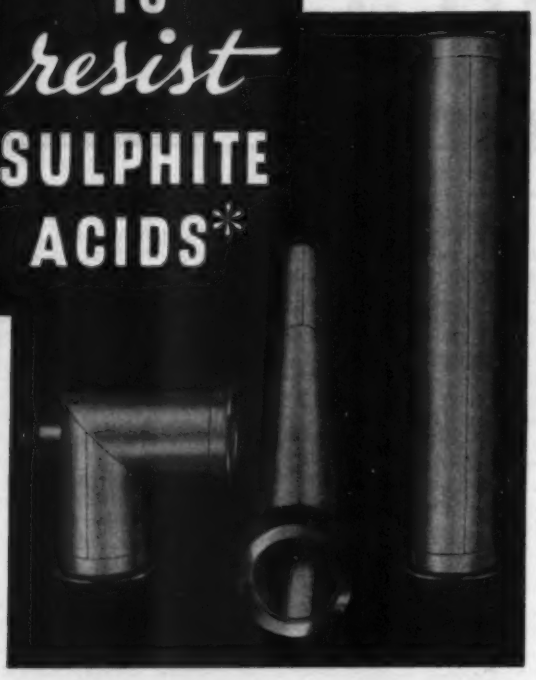
An additional increase in export shipments of paper from the United States was scored during November last, when exports reached a total value of $1,471,189, according to official U. S. Department of Commerce figures, comparing with shipments of a declared value of $1,368,431 in the month before, and $1,110,067 in November, 1932. The November exports last year brought the total for the first eleven months up to a value of $12,968,017, contrasted with $14,249,020 in the similar time in 1932. Thus, eliminating imports of newsprint paper, the United States exported a greater value of paper than was imported in the first eleven months of 1933, the exports totaling in value $12,968,017, and the imports—excepting standard newsprint—being valued at $7,832,398.

Exports of newsprint paper from the United States in November last were 1,780,509 pounds, valued at $38,320, against 1,057,865 pounds of a value of $27,493 in the same 1932 month, and bringing the total for the first eleven months of 1933 up to 17,681,759 pounds, valued at $360,369. Export shipments of uncoated book paper during the first eleven months of last year amounted to 16,634,394 pounds of a declared value of $779,644, while wrapping paper exports in the same period were 21,596,707 pounds of a value of $1,111,528, and writing paper exports reached 12,389,219 pounds of a value of $803,495. Exports of tissue and crepe in the eleven-month period were valued at $500,893; of cover paper, $96,018; of greaseproof and waterproof paper, $701,063; of sheathing and building paper, $159,036; of blotting paper, $133,527, and of toilet paper, $481,166.

Exports of boxboard, paperboard and strawboard in the first eleven months of 1933 reached a value of $807,679, and of other paper board $600,493. Paper bag shipments abroad were valued at $480,073 in the eleven months, and paper box and carton exports at $412,691. Paper envelopes to a value of $115,948 were exported in the similar time.

Exports of paper base stocks, comprising wood pulp, rags, etc., were valued at $3,360,061 in the first eleven months of last year, compared with shipments of a value of $2,482,303 during the similar period of 1932.

TO *resist* SULPHITE ACIDS*



The above illustration shows *CHROME-NICKEL-MOLYBDENUM stainless steel piping for digester service at 125-lb. pressure.

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When a felt is through and ready for the rag man, sell it. Much better, though, to give it fair treatment and make it deliver maximum service before listening to the rag man's song.

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Piqua, Ohio.

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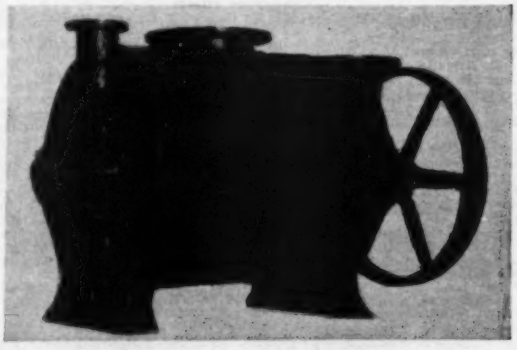

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Moore & White Co.
Smith & Winchester Co.

Reels (Automatic Collapsing)
Hudson-Sharp Mach. Co.

Refiners
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Love Brothers, Inc.
Sturtevant Mill Co.

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Taylor Instrument Co.

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Samuel M. Langston Co.
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Smith & Winchester Co.

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Link-Belt Company

Rolls
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Carthage Machine Co.
Downingtown Mfg. Co.
Enterprise Machine Co.
Rodney Hunt Mach. Co.
B. F. Perkins & Sons, Inc.

Rolls (Embossing)
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Rolls (Rubber Covered)
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Rosin Size
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Carthage Machine Co.

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Carthage Machine Co.

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J. T. Ryerson & Son, Inc.

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Moore & White Co.

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American Rolling Mill Co.

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J. T. Ryerson & Son, Inc.

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American Sheet & Tin Plate Co.

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Beloit Iron Works
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Jeffrey Mfg. Co.
Link-Belt Company
Morse Chain Co.

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Philadelphia Quartz Co.

Slitting & Rewinding Mach.
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Cameron Machine Co.
Hudson-Sharp Mach. Co.
Samuel M. Langston Co.
Moore & White Co.
Smith & Winchester Co.

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Grasselli Chemical Co.
Paper Makers Chem. Corp.

Sodium Metasilicate
Philadelphia Quartz Co.

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Commercial Solvents Corp.

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Enterprise Machine Co.
Hudson-Sharp Mach. Co.
E. D. Jones & Sons Co.

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Morse Chain Co.
Poole Foundry & Machine Co.

Splitters (Wood)
Carthage Machine Co.

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Moore & White Co.

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Moore & White Co.

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Carthage Machine Co.

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The Bristol Co.

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B. F. Goodrich Rub. Co.

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Hamner-Stander Tank Co.
Rodney Hunt Mach. Co.

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Taylor Instrument Co.

Thickness Control (Paper)
Enterprise Machine Co.

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Towel (Interfolding Machine)
Hudson-Sharp Mach. Co

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Link-Belt Company
Moore & White Co.

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Rodney Hunt Mach. Co.

Turbines (Steam)
General Electric Co.

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Paper Makers Chem. Corp.

Valve Rails & Discs
B. F. Goodrich Rub. Co.

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Wm. Powell Co.

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Duriron Co.
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Wm. Powell Co.

Valves (Gate)
Enterprise Machine Co.
Jenkins Bros.
Wm. Powell Co.

Valves (Non-return; Emergency Stop)
Jenkins Bros.
Wm. Powell Co.

Valves (Relief)
Rodney Hunt Mach. Co.
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Wm. Powell Co.

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Ventilating Fans
B. F. Perkins & Son, Inc

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Moore & White Co.

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Downingtown Mfg. Co.
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Moore & White Co.
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Appleton Wire Works

Wood Grapples
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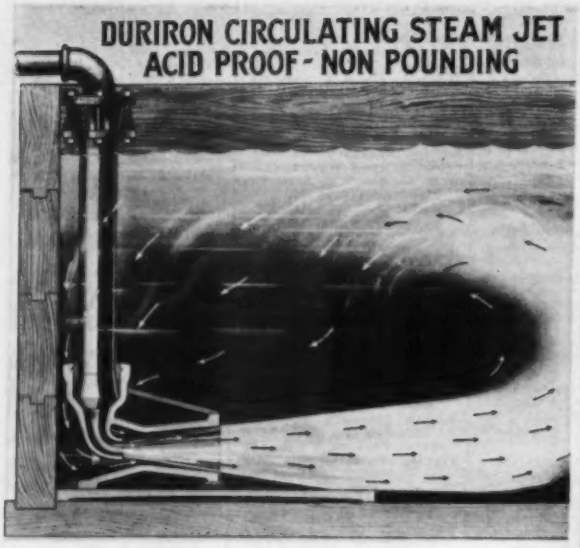

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For thoroughly dissolving alum and to give the Superintendent complete control over the strength and amount used, The Duriron Dissolved Alum System has proved to be the most effective and satisfactory.

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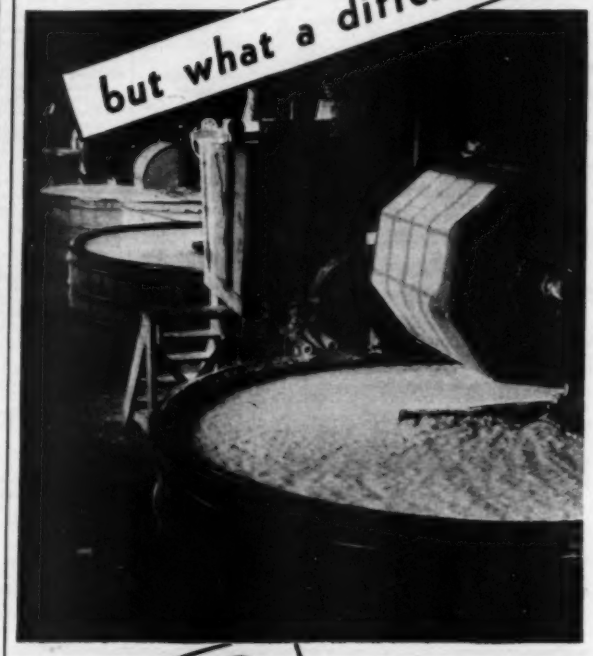

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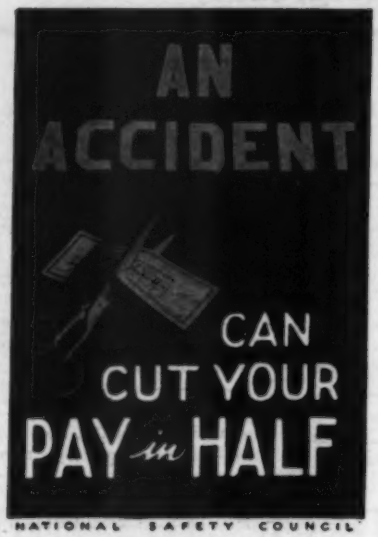

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National Safety Council

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